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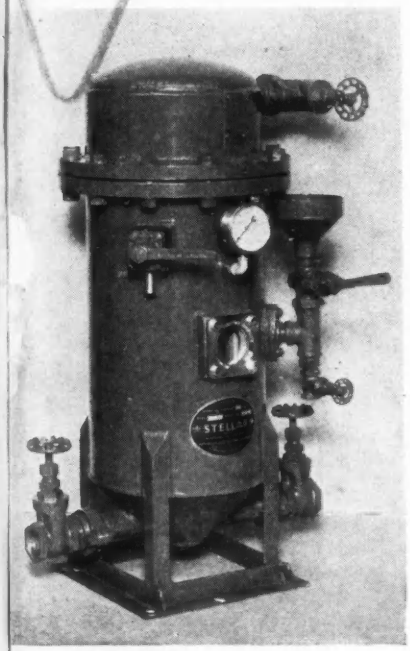

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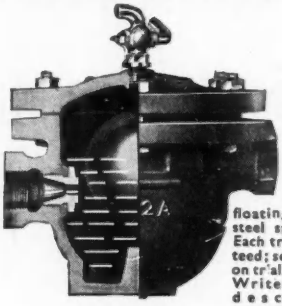

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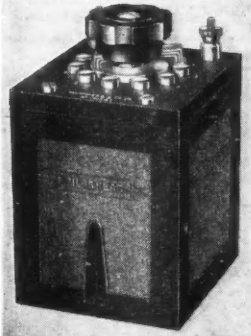

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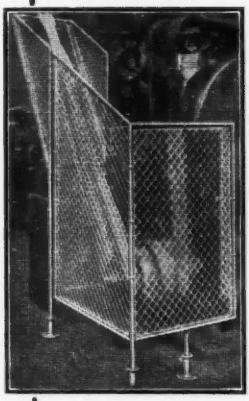

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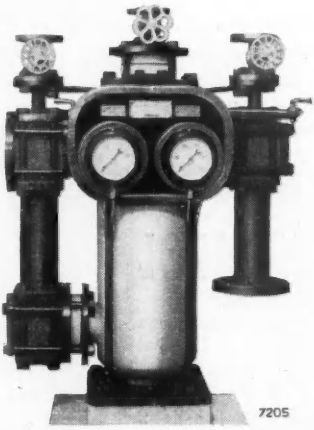

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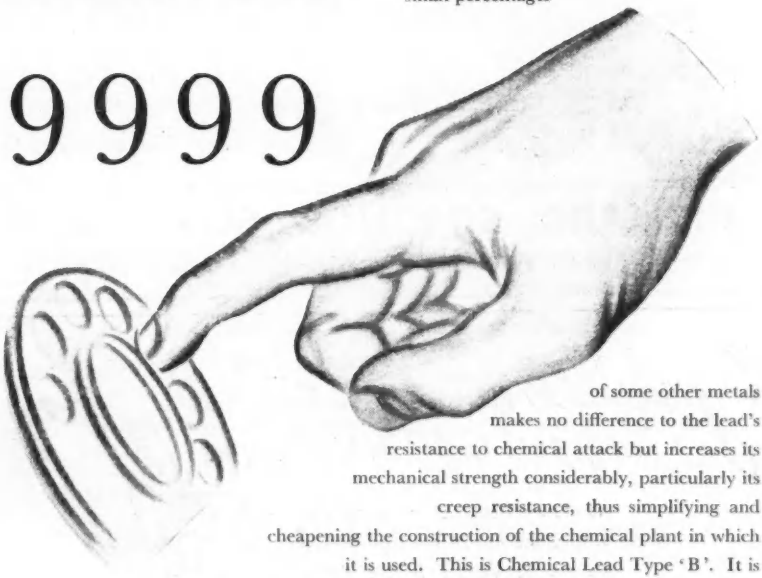

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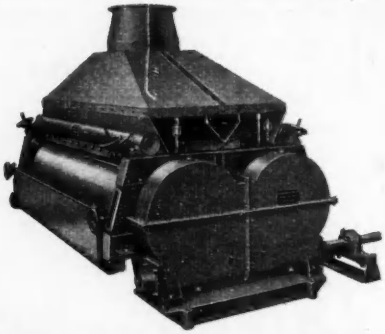

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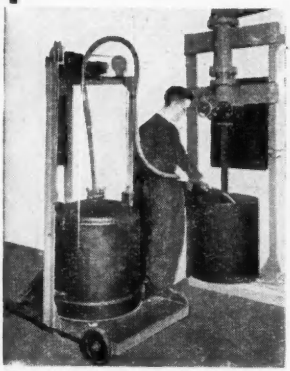

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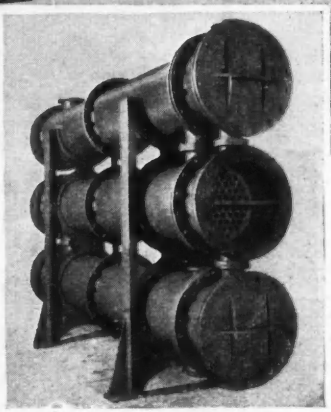

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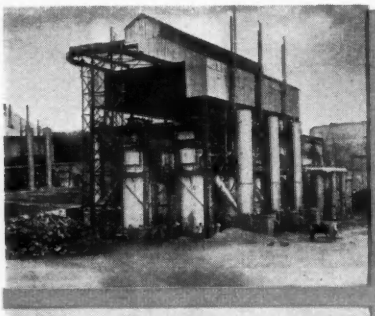

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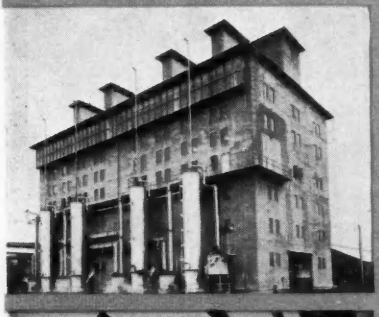

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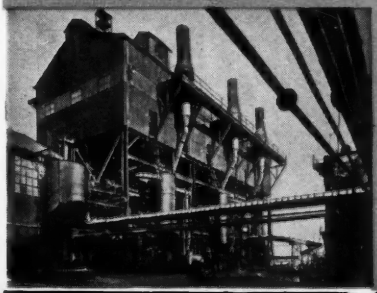

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Chemical Plant and the Budget

FOR the chemical industry the suspension of the 40 per cent initial allowance for new plant and machinery is a major consequence of Mr. Gaitskell's budget. That twelve months' warning of this change has been given is only frigid comfort. A heavy wear-and-tear rate for plant is part of the chemical industry's nature. Also, the rate at which new products and new processes develop is faster than in any other branch of industry. For these two reasons a vigorous and progressive chemical industry must be frequently scrapping and replacing its plant. It is doubtful whether any other industry will feel the loss of the 40 per cent allowance more sharply. Only last month Sir Ewart Smith said at the annual luncheon of the B.C.P.M.A.: 'On the question of prices, it is possible to kill the goose that lays the golden eggs; and when a manufacturer has to assess plant on a large scale, major types which cost up to £1,000 capital per ton-year product, and convert that back, with its obsolescence and its interest, it is quite clear that the capital charges could easily be equal to all the other costs . . . or more than equal.' There can be little doubt that the 40 per cent initial allowance scheme, introduced in 1945, has been a notably influential factor in most chemical industry plans to install new and costly plant.

The irony of Mr. Gaitskell's decision is that the Tucker Committee, whose report was published a few days before the budget, recommended that the initial allowance should become a more significant instrument of fiscal and economic policy. This specific item of profits-tax relief was given particularly detailed consideration by the Committee. It was recommended that a minimum rate of initial allowance should be prescribed and that different industries should, through their trade associations or federations, negotiate with the Treasury for special rates in excess of the general minimum. 'An advantage of such a system would be that the authority responsible for determining the appropriate rates could be empowered to take into account not merely the rise in price levels but also the importance of the particular branch of industry concerned to the national economy.'

The logical basis of the 40 per cent allowance has been admirably explained in the Tucker Report. A plant that cost £100 in 1937 may in equivalent form have cost £200 in, say, 1946. The total annual allowances on the 1937 plant will have amounted to the full £100 by the time the replacement date was reached. 40 per cent of the new price, £200, is £80; in addition, the first annual allowance is probably 10 per cent, that is, a

further £20. Thus, the full £200 required is given *fair* taxation relief when plant costs have doubled since the former plant was installed. But if this was roughly the situation in 1945 and 1946, it is far from the situation in 1951 and the inevitable situation in 1952. New chemical plant is more than twice its 1939 or 1940 cost now; soon, if not already, a trebled cost must be taken as the normal standard. And, as the Tucker Report shows, a 40 per cent initial allowance is insufficient to provide fair tax relief in these circumstances. The percentage should rise to 60 per cent. However, the Committee rejected the idea of a general increase to this figure. It was felt that a statistical survey of plant and machinery costs would reveal wide differences in increased costs as between different types of plant and different branches of industry. For this reason the minimum rate recommendation was made, leaving it open for Government and industry to agree upon specific upward variations for specific branches. Had such a course been followed, or at any rate had Mr. Gaitskell left the 40 per cent allowance alone for the time being so that in due course these constructive proposals could be adopted, the chemical industry would have been one of the principal beneficiaries. Its plant costs are high; and its products, largely as vital intermediate materials, stretch across the entire front of national priority.

Instead, Mr. Gaitskell has said that 'production departments' must take measures to ensure that the suspension of the allowance will not handicap those firms which are engaged in the rearmament programme. For a diversified industry this is far too vague. Will it cover the costs of re-equipping sulphur-using plants so that pyrites or other materials can be used instead? Will it meet the costs of expanding plant to produce synthetics for closing some of our widening raw material gaps? How, unless the full wartime pattern of priorities comes back again, can the national importance of any chemical material be judged? For the growing problems of financing new developments in the chemical industry, the Tucker Committee's recommendations offered hope and certainty. The budget proposals offer only confusion and uncertainty. The main object in suspending the 40 per cent allowance is said to be the prevention of competition between armament and non-armament firms in securing new machinery. In fact, this competition for every sort of equipment will be intensified during the remaining twelve months in which the 40 per cent allowance still operates.

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Notes & Comments

The Best Use of Fuel

IF British industry is to survive, greater attention must be paid to the more efficient use of fuel, said Mr. B. E. A. Vigers, assistant managing director and chief engineer, Laporte Chemicals, Ltd., speaking on 'What We Can Do Now' at a conference on industrial fuel efficiency, sponsored by the Ministry of Fuel and Power, held last week at the Mansion House, London. One of the main problems was a psychological one. We were all prone to think we were not so bad as the other fellow, and any suggestion at improvement tended to be thought of as unwarrantable interference. Fuel economy must be made the primary duty of some senior individual at high level—preferably the chief engineer—who must be given full support all the way. On the technical aspects, it was essential to have regular inspection of the brickwork and flues of boilers, keep lagging in good condition, and for fitters to keep a regular schedule of maintenance on steam traps. Instrumentation and automatic controls could do wonders, but required organisation to see they were kept in operation. Speaking on the 'Task Before Us,' Mr. Alfred Robens, Parliamentary Secretary to the Ministry of Fuel and Power, emphasised that making the best use of fuel should be regarded, not as a temporary measure but as a vital long-term matter. The success of bringing the laboratory to the workshop had been amply shown by the Mobile Testing Unit Service, organised by the Ministry of Fuel and Power, which was now placed on a permanent basis. It had been shown that a potential saving of not less than 22 per cent of fuel could be achieved if the recommendations of the testing engineers were carried out. In addition to the four units to deal with the requirements of large firms, 12 light units were now available to the medium-sized and smaller firms. One criticism of the service was made that a firm had to wait five months for the report from the experts. Long delays such as this were now being smoothed out. The gathering, which was attended by several hundred representatives of the large proportion of industry concentrated in and around London, was opened by the Lord Mayor (Mr. Alderman Denys Lowson). Such an opportunity to discuss frankly the present problems, to look ahead, and consider what aids and services can be used is a welcome sign that industry is becoming more alive to the vital need for the efficient use of fuel.

The Turn of the Screw

THE fact recently published that the difference in thread between British and American screws and bolts in the last war added £200,000,000 adaptation costs to the U.S. war bill, may not cause more than a perfunctory whistle in the tinkering amateur whose engineering prowess is limited to keeping his bicycle running. What it will undoubtedly bring home to anyone with a close knowledge of industry and its problems—if they do not know it already—is the cost of having unstandardised articles, however small, in general use and circulating freely, especially when these are as fundamental as the thread of a screw. Financial cost is always unimportant in war, but the stupifying figure mentioned above does give some idea of the equivalent cost in production difficulties had standardisation not been carried out. And standardisation is no easy process. The fact that the committees of the British Standards Institution sit for years before deciding the means and particular form of standardisation is adequate proof that it takes more than someone to say 'standardise it' for the miracle to happen. Like tramlines, it is expensive to lay but negligibly cheap to run, and when it is standardisation between nations and not between industries, it constitutes a very definite step towards the goal of a common world. Politicians come and go, and the fickleness of public opinion shifts overnight, but the rock of industrial and economic concord between this country and the U.S., started during the war with lease-lend and co-ordination of

production, adds slowly but inexorably to itself. These measures of international co-operation are greater than many people think. If only the people getting wild about American admirals in the Atlantic knew it, the Royal Navy abandoned its precious system of flag signalling—evolved from Trafalgar—in favour of a largely American compounded system years ago. Such acts of mutual progress as these are worth thirty times more in terms of peace and plenty than a whole host of international, top-level conferences.

Cut the Cackle

NO one can possibly complain that they have not been told about what the sulphur shortage can, and probably will do to them. Grim warnings have been issued by the Government with their usual cheerful optimism, but grim warnings have become a major part of our national economy these days, and when everyone from Cabinet Ministers down to civil servant clerks has stopped issuing pleas, threats and forecasts we do not find that telling one another about it has got us far along the road to an assured sulphur supply. What are the facts in this too much discussed dilemma? Fact one: American supplies are dwindling and she is shortly no longer going to be able to act Lady Bountiful to this country and the rest of Europe as she will have to produce sulphur in other, more expensive, ways herself. Fact two: the other, more expensive, ways consist of extracting the element with more or less difficulty from either pyrites—expensive, long-term and made from imported but plentiful non-dollar materials; anhydrite—expensive, again long-term, but made from plentiful indigenous materials; or from waste product recovery either as sulphur dioxide or hydrogen sulphide—very expensive but allied to the problem of smog prevention and already in use in guinea-pig form. Other helpful suggestions on sulphur recovery have also been published from time to time by the TIDU of the Board of Trade from information based on captured German war documents (see THE CHEMICAL AGE, 10 March and 14 April, 1951). All these methods, however, will not be effective for two or three years. Fact three: the only other sources of native sulphur outside America are from Sicily, where it is expensive (see THE CHEMICAL AGE, 14 April, 1951) and possibly Iceland.

Parliamentary Questions

IN Parliament this week the President of the Board of Trade was subjected to a thorough cross-examination on the sulphur position, and through his replies betrayed the extent to which the Government is responsible for the present shortage. Shortage of sulphur, said Mr. Wilson, was foreseen both in America and this country two years ago. In answer to a question, he said that the steps the Government took to remedy this at that time were to limit the erection of any further sulphur-burning acid and other plants, and see that in the future they were of the type that used sulphur in some other form. Purchases of sulphur, he said, were never restricted in order to save dollars. But actual sulphur rationing by America did not come into force until October last year. What was the Government doing for 18 months before that? It was possible to build up stocks during that period, when no rationing was in force. But dollars evidently came first. Immediately rationing was instituted, the Government imposed what they call an *ad hoc* cut of one-third on all sulphur supplies to industry. Were there no reserves built up *at all*? It is no use, however, crying over spilt milk, and if nothing else can be done in a hurry, at least economy and more economy in the use of sulphur must be practised. And let the Government remove all tariffs on imported sulphur from the Continent. To say that manufacturers are already paying five or six times the U.S. price for it, and so the tariffs 'do not seem to make much difference,' is an incredible statement coming from a Minister of the Crown. It seems that the Government is getting over this crisis, like many others, simply by putting the responsibility on America and confining itself to rationing out what sulphur there is, without doing anything else about it. Unfortunately, industry has more serious things to think about than who is to blame, and no amount of rationing will ever produce more sulphur.

Fertiliser Manufacture

Further Research on Sulphurless Processes

AT a meeting of the Fertiliser Society on 12 April, Dr. F. M. Reynolds, B.Sc., Ph.D., read a paper on recent research carried out at the Chemical Research Laboratory on the economic production of phosphate fertilisers using nitric acid. A previous paper on the same subject was read to the Society on 15 February (*see* CHEMICAL AGE, 24 February, 1951), by Dr. M. H. R. J. Plusjè, of Holland, who described solution methods of obtaining mono- and dicalcium phosphate and a compound phosphate/nitrogen fertiliser using nitric acid solely.

Dr. Reynolds said that the two main items on the programme of the Chemical Research Laboratory have been: (1) Nitric acid processes as above; (2) Fusion processes—more particularly the fusion of rock phosphate with magnesium silicates. Analysis of very diverse samples have also led to some study of analytical methods.

Summarising previous work on the nitric acid processes, Dr. Reynolds said that the older method of treating the rock in the same way as with sulphuric acid has largely fallen out of favour and given way to solution methods. On the Continent these are based on the crystallisation of calcium nitrate, leaving enriched solutions of phosphate from which calcium phosphates are precipitated, an expensive and complex process. In America, however, chemists of the Tennessee Valley Authority have been working on the ammonia neutralisation of the acid solution to give dicalcium phosphate.

Nitric Acid Alone

The Chemical Research Laboratory, said Dr. Reynolds, has been experimenting with both direct and solution methods on fluorapatite, a low-grade phosphate rock containing fluorine. It has found that the old 'Norsk Hydro' 1930 method of direct application of 61 per cent nitric acid gives the best nitrophosphate product, in spite of a more recent report (1948) that a concentration of 70-75 per cent is necessary, giving optimum setting properties and no loss of nitrogen through decomposition, as is observed using the stronger acid. The product remains dry so long as the humidity is below 55 per cent, but it deliquesces beyond that, making it difficult to prepare an agricultural product—a conclusion also reached by the T.V.A.

In contrast to sulphuric acid, nitric acid liberates no fluorine from fluorapatite. The residual fluorine however, does not revert the phosphate, as has been held in the past.

Solution Methods

Solution methods of precipitating dicalcium phosphate from a nitric acid solution of fluorapatite have been found to be perfectly satisfactory provided that the following conditions are observed: a concentrated solution of phosphate; 1: 1 ammonia added gradually so as not to exceed a *p*H of some 5.5-6; and the temperature kept below 40°C. In these conditions the precipitate is coarsely crystalline. (Lime or chalk may be used instead of ammonia, but with chalk excessive frothing occurs). These conditions have been derived from crystallising dicalcium phosphate from a solution of laboratory grade tricalcium phosphate in nitric acid.

The new Dutch process, said Dr. Reynolds, is at the moment being studied with regard to fluorapatite, but up to the present success has been slight due to clogging of the filters by rock impurities when the liquid is cooled to 5°C. for precipitation of the calcium nitrate. Centrifuging may solve the problem, but an inherent disadvantage of this process as applied to fluorapatite is the fact that it cannot be placed on a satisfactory theoretical basis, since fluorine is involved and this upsets the equilibrium of the system CaO-P_2O_5-N_2O_5-H_2O on which the Dutch system is based.

Nitric/Sulphuric Acid Mixtures

The mixing of sulphuric with nitric acid in the direct application method has been relatively ignored. It has the advantages, however, of being a very vigorous reaction and therefore brief, and of giving a rapid-setting product that sets dry over a wide range of mixtures. The presence of a little calcium sulphate which probably coats the nitrate grains may account for this effect. The hygroscopicity varies with the amount of nitric acid used, and optimum conditions have been found to be a 50: 50 mixture

of acids with 80 per cent of the theoretical amount of acid at 66 per cent strength. The product contains 23 per cent of calcium nitrate, yet picks up practically no moisture at high humidities. Of the fluorine 90 per cent remains behind, so saving 18 per cent of the acid, and any loss of nitrogen in high temperature reactions can be controlled by lowering the acid strength by 2-3 per cent. Moreover there are no 'time reactions' as with sulphuric acid alone, and the phosphate solubility does not alter on storage. The 66 per cent acid is about the strongest that can be used at ordinary temperatures, although as it is below the minimum necessary for hydrate formation, some free moisture is present in the product. Acid of 70 per cent can be used (if cooled to 5°C.), which contains no free moisture and gives a richer, more granular product (but not rich enough to pay for the cooling), but it picks up more water in the long run than the 66 per cent acid product.

Introduction of KCl Tried

The introduction of potassium chloride has also been tried, said Dr. Reynolds, and is feasible, provided that it is added when the primary reaction has reached an advanced stage, to prevent loss of HCl gas. The mixture sets almost as well as before, but hygroscopicity is increased, and the addition of ammonia or increasing the sulphuric acid proportion does little to lower it.

Addition of ammonia has also been tried as a means of improving the 'condition' of the nitrophosphates, but even small amounts (0.8 per cent) soon produced reversion (fall in citric-solubility—4.4 per cent). The explanation of this, said Dr. Reynolds, is not known. Using 10 per cent more acid has little effect, and the only other common causes of reversion—over-ammoniation due to uneven application of the ammonia, and overheating—can hardly have occurred under the conditions of the experiment. Morever, although high fluorine content and much free moisture might be thought to be causes of reversion on storage, the only compound which actually shows reversion is the P/N fertiliser containing 17 per cent free moisture, prepared with only 55 per cent acid—the most moist of all the compounds tested.

Coking properties of typical P/N and P/N/K fertilisers have also been examined, and the rather surprising conclusion reached that fertilisers containing $CaVo_3$ are relatively non-caking when compared with a fertiliser corresponding to No. 1 National Compound.

Fusion with Magnesium Silicates

Various high temperature processes for the solubilisation of rock phosphate have already become well-established, said Dr. Reynolds. The Chemical Research Laboratory has been examining the so-called olivine-fusion process, which is a comparatively recent process developed mainly by the T.V.A. in America, using a fairly common magnesium silicate—serpentine. The fusion temperature needed is about 1,500°C. while the product has to be rapidly quenched to give a satisfactory citrate-solubility. The Americans use a molybdenum-wound furnace and molybdenum crucibles, entailing working in an atmosphere of nitrogen (in hydrogen some phosphorus is lost), but the C.R.L. has attained 1,600°C. using a gas-fired muffle furnace without any special features, and platinum crucibles which withstand a number of fusions before being seriously attacked. As far as quenching is concerned, it has been found that although pouring out in air produces a citric-solubility much the same as in the original rock, pouring into water gives a citric-solubility as high as 98 per cent. Varying the SiO_2/P_2O_5 ratio elucidates that with a ratio of 2 or more, virtually complete citric-solubility is secured—as the American workers found. With a ratio of 2 the total P_2O_5 content is 22 per cent. The temperature attained in the melt if it is between 1,450 and 1,600°C., and the time the melt remains in a fused state do not alter the citric-solubility. Scottish olivine or talc used in place of serpentine gives substantially similar results.

Several Fluxes Tested

To make the process economically more efficient, a decrease of 200°C. or so in furnace temperature would be advantageous, and several fluxes have been tried. Addition of 5 per cent silica raises the temperature, however, and although iron oxide lowers it slightly, all the fluxes tried suffered from some disadvantage or other. This makes these high-temperature processes feasible only in the vicinity of cheap power and raw materials. The olivine-fusion process was considered a possible alternative to the superphosphate process during the last war, but in the present world situation it may well have to be adopted in peace. There

are fairly extensive deposits of magnesium silicates in Britain, although it is not certain that they are adequate for full industrial development, and talc is mined in several places in Scotland—the accompanying serpentine being at present quarried to waste. There is only one plant in use in America at present (by Manganese Products, Inc.), and it is estimated that to produce 125 tons of calcium magnesium phosphate per day costs about as much as a 5,000 kVA ferro-silicon plant and consumes some 950 kWh per ton. Shock-cooling the product necessitates a water consumption of 1,000 gallons per ton, but original fears of corrosion due to the melt have been overcome by using a water-jacket to freeze a thin layer of slag on the furnace lining. In America, however, the citrate test is admissible, and this product, although it has ideal physical properties—granular, dense, odourless, free-flowing, non-hygroscopic, non-caking and non-corrosive—has no water-soluble phosphate, although its available phosphate compares favourably with ordinary superphosphate.

Various Analytical Methods

Other materials have also been tried for fusion in the C.R.L., but none have been at all promising. Mixtures of rock phosphate with silica or calcium silicate do not fuse at 1,500°C., only sinter, with no increase in phosphate solubility. Soda glass behaves similarly. Alkali metal chloride or calcium chloride fusion gives higher solubilities, but although they fuse at lower temperatures the melts are highly corrosive and the salts are hard to recover.

At the end of his paper, Dr. Reynolds described the analysis methods used by the C.R.L. In phosphorus determination, the tediousness of the ignition-to-pyrophosphate method and the empirical basis of the alkalimetric titration method has been dispensed with by precipitating the phosphorus as phosphomolybdate as before, but at boiling point and in the presence of citric acid, when the precipitate is formed immediately. This is titrated using a mixed indicator which gives the stoichiometric end-point. Only silica interferes, but this is removable quite easily beforehand.

Colorimetric determination is quite satisfactory using the yellow colour of molybdivanadophosphoric acid obtained by adding ammonium vanadate to acid orthophosphate solution, followed by excess ammonium molybdate. The colour is not given by meta- or pyrophosphate, and is rapid, sensitive and relatively free from interference. It has largely superseded the older molybdenum blue method, and the only modification to Kitson & Mellon's procedure recommended by the C.R.L. lies in using a hot solution of phosphate to hasten the colour development. Accuracy is 2-3 per cent of the total phosphate and the colour is extractable with n-butanol, in which it can be estimated.

Soluble phosphate is estimated in the usual way, but by determining the phosphate in the residue rather than the solution. Turbidity is found to be mainly due to silica, and has a negligible phosphate content. Raising the temperature by 10°C. increases the apparent solubility by 1-2 per cent, a great effect. Nitrogen is estimated by Devarda's method, and fluorine by distillation as SiF_4 followed by titration with thorium nitrate. The determination of moisture has been difficult, however, and distinguishing between free and combined moisture has been nearly impossible due to decomposition of product (with toluene distillation) or incomplete drying (sulphuric acid *in vacuo*). In any case, these moisture figures are only significant on account of their relevance to the question of reversion, and are calculated satisfactorily on the assumption that each mol of $-NO_3$ exists as $Ca(NO_3)_2.4H_2O$.

Amphibious Sulphur Mining

THE new scheme for mining sulphur from waterlogged areas near New Orleans, Louisiana, in furtherance of the U.S. policy of exploiting previously inaccessible sulphur beds, will go into operation shortly. The mining plant, of the Hermann-Frasch type used in Texas, will be mounted on a huge steel barge, and the high temperature water required for pumping into the earth to melt the sulphur and force it to the surface will be produced on the barge at the rate of 2,000,000 gallons a day. The area being worked is 75 miles from any main industrial facilities, and this will mean erecting shops, warehouses and other auxiliary buildings on barges, and floating them out to the mining sites. Drilling operations will be conducted from floating rigs passed along specially dredged channels, and the sulphur will be piped in molten form to solid ground.

Chemistry and Food

Busy Year Reported by S.C.I. Group

TWO major developments marked the 1950-1951 report of the Food Group Committee of the Society of Chemical Industry.

The first was the elevation of the Microbiological Panel to the status of a Group, the inauguration of which took place on 7 March, 1951. The occasion was marked by a special meeting at the Royal Institution when Professor A. J. Kluyver, of the Technische Hoogeschool, Delft, Holland, delivered an address on 'Microbial Metabolism and its Industrial Implications.' Mr. H. J. Bunker, M.A., will be the first chairman.

An agreement that the Food and Agricultural Groups were so closely interconnected that there should be a stronger link between them, was the second development. A request to consider the formation of specialised Groups of the Society was received from the president. A special sub-committee, including representatives from the Agricultural Group was accordingly set up, and a report submitted on 31 January, 1951.

The proposal that an Oils and Fats Group should be formed, and that steps had been taken by the Council to inaugurate it, was warmly welcomed.

An opportunity to return some of the hospitality from scientific friends in Europe was afforded when it entertained a party of Danish Food Chemists on a visit to this country.

New Equipment on View

New apparatus and equipment for use in the food industry were on view and a film of the summer tour to Norway was shown at the annual conversazione.

Twelve scientific meetings were held, and subjects discussed included the following:—'Some Consequences of a Virile Chemical Industry on Food Processing'; 'The Significance of Aqueous Vapour Pressure in the Food Industry'; 'Applications of Paper Chromatographic Methods in the Sugar and Allied Industries'; 'The Training of Technologists'; and Radioactive Tracer Studies on the Fate of Insecticides.'

The Microbiological Panel held five meetings comprising 16 papers on such diverse subjects as air disinfection and sterilisation, electron and phase-contact microscopy, the cytology of bacteria, and the microbiological aspects of brewing.

Following the joint report of the Food Group and the Society of Public Analysts and Other Analytical Chemists on Preservative Regulations, a Sub-committee has been recently appointed by the Food Standards Committee of the Ministry of Food. Dr. E. B. Hughes, vice-chairman of the Group, will represent the Society on this committee.

Membership of the Group has remained fairly steady at approximately 1,100. Mr. A. L. Bacharach terminates his two-year period as chairman in July, and will be succeeded by Professor H. D. Kay, who has already served the Group as chairman of the Microbiological Panel.

Dr. R. J. Nicholls, who has been honorary treasurer since 1942, retires from office this year on his election to the presidency of the Society of Public Analysts and Other Analytical Chemists.

Another Fertiliser Process

YET another process for economising in or dispensing with sulphuric acid for the production of superphosphate from phosphate rock is announced by the Department of Scientific and Industrial Research. Nitric acid if used alone, the Department points out, gives the hygroscopic calcium nitrate as a by-product, which takes too long to remove and anyway increases the cost of the fertiliser. Leaving it in the superphosphate is no solution as the fertiliser then cakes in storage and becomes useless to the farmer. The Department say that they have recently carried out successful tests on the treatment of phosphate rock with a mixture of nitric and sulphuric acids in the ratio of 4 to 3. This produces calcium sulphate as well as calcium nitrate and phosphate, and as calcium sulphate is inert and coats the grains of calcium nitrate, the product as a whole is relatively non-caking, and will keep reasonably dry in the normal British climate, claim the Department. Experiments have also been carried out to produce a 'complete' fertiliser by adding KCl, the chief source of potash. A P/K/N fertiliser containing 10 per cent of potash was prepared. This material was more sensitive to moisture, but its laboratory tests were very severe and it is likely to prove a reasonably good product in practice.

The Research Programme for Heat Transfer

KNOWLEDGE of the mechanics of heat transfer is considerably behind that of most related subjects. For more than forty years engineering undergraduates at British universities have been able to attend lectures and pass examinations on such subjects as strength of materials, theory of structures and theory of machines. On the heat side there have been courses and examinations on applied thermodynamics, but with only very limited reference to heat transfer. Thus, this very important subject has till recently been regarded virtually as a 'side line,' with the result that engineers know far more about the strength and mechanical properties of materials than they do about heat transfer.

Yet heat transfer is taking place all the time and plays an essential part in almost every industry. In food manufacture most processes involve the use of heat for such purposes as evaporation, sterilisation, etc., or of refrigeration to prevent products from going bad. Heating appliances of various types are installed in every home. Internal combustion engines and gas turbines require to be cooled. Heat transfer plays a particularly important part in chemical engineering, the chemical industries and power generation. Gas turbines, for example, involve the use of heat exchangers in which heat is transferred from a hot to a cold fluid. Steam turbines require condensers.

Committee Set up in 1945

Various DSIR stations are concerned with applied research in the field of heat transfer. The Fuel Research Station studies the effects of combustion and what happens to the heat produced. The work of the Food Investigation Organisation involves the study of refrigeration, while the heating of houses is studied at the Building Research Station. So far, however, there has been no organisation which undertakes fundamental research in the entire field of heat transfer, or applied research on heat transfer in relation to mechanical and chemical engineering.

A Committee was set up in 1945 by DSIR which reported on the essential needs for research in mechanical engineering. As the committee has pointed out, recent developments in the compressible flow of gases and transformation of energy will call for heat transfer data under unprecedented conditions, while the future development of several branches of engineering is dependent on a knowledge of basic thermodynamic properties of various fluids, working substances and refrigerants over ranges of temperature and pressure far beyond those already known.

Need Recognised

Recognition of the necessity for much more research in this vital field is reflected by the extensive provision for the study of heat transfer, which is a marked feature of the long-term programme for mechanical engineering research. This programme includes the establishment of a specialist laboratory at East Kilbride in which experimental work will be carried out on a substantial scale on practical heat exchange apparatus.

After a comprehensive review of the work being done by Government establishments, research association and industrial firms, the committee reached the conclusion that, despite the considerable amount of work already in progress, the development of mechanical engineering was so fundamental to industrial development generally, as to warrant the establishment of a new research organisation of the department to undertake basic and generic research not systematically conducted elsewhere.

Effect was given to certain recommendations of the committee by the establishment of the Mechanical Engineering Research Organisation and the appointment of the late Dr. G. A. Hankins as Director. Dr. Hankins died in November, 1950. His successor has not yet been appointed but Dr. D. G. Sopwith, the Superintendent of the Engineering Division of the National Physical Laboratory, is at present in charge of the work of this organisation. Certain items of the research programmes of the Engineering and Metrology Divisions of the National Physical Laboratory were taken over by the new organisation. A Mechanical Engineering Research Board under the chairmanship of

Sir Henry Guy, C.B.E., D.Sc., M.I.Mech.E., F.R.S., was appointed to advise the Department. This Board is in turn advised by a number of committees, those concerned with heat being the Thermodynamics Committee under Professor D. M. Newitt, and the Heat Transfer and Heat Exchange Apparatus Committee under Professor O. A. Saunders.

Since its formation MERO has been mainly engaged in formulating the future research programmes, planning the general lay-out and buildings for the new laboratories, and selecting and ordering the equipment required. Its work also includes researches at present in progress and initiated under extra-departmental arrangements with universities, etc.

To be Completed this Year

One of the first questions to be decided was where the future research station should be situated geographically and after discussion the new town of East Kilbride in Scotland was selected. It is anticipated that the first laboratories at East Kilbride will be completed this year.

Until the new research station is available use is being made of temporary facilities at Thorntonhall, near East Kilbride. The temporary offices of the organisation are now at Thorntonhall.

MERO's total staff is now about one hundred and thirty and is still growing steadily. The organisation comprises seven major divisions, each of which is responsible for research in a group of related subjects.

These divisions are concerned respectively with:—

A. Properties and strength of materials.
B. Mechanics of solids, stress and vibration.
C. Mechanics of fluids, including hydraulic machinery.
D. Lubrication, wear, corrosion.
E. Mechanisms, engineering metrology and noise control.
F. Mechanics of formation and machine shaping of materials.
G. Heat transfer and applied thermodynamics.

It will be noted that Divisions A, B, and F are all concerned with the properties of materials in one form or another. Work on the properties of materials at high temperatures will be carried out by these Divisions, while work on corrosion is included with lubrication under D. Of considerable importance to chemical engineers are the mechanics of fluids, in which connection research will be carried out in all types of fluids under the usual conditions encountered in chemical engineering plants. Division E deals with mechanisms and will therefore be concerned with control circuits, etc., which are also of interest to chemical engineers.

Mr. E. J. Le Fevre is in charge of the Heat Division, which at present consists of three main sections. One section is concerned with the collection and presentation of thermodynamic data for technically useful gases and gas mixtures. The fundamental heat transfer section will deal with all the more fundamental aspects of heat transfer, with special reference to such factors as convection under carefully controlled conditions. In order to obtain a real understanding of what happens in heat transfer by convection, it is often necessary to study the problem under conditions which are much more strictly controlled than those arising in industry. The third section of the division will be concerned with applied heat transfer, which embraces the testing of heat exchange plant.

In the field of heat transfer the mechanical engineer's interests are liable to be confined mainly to air, water, steam and oil. MERO is approaching the subject very much more broadly and is setting out to obtain heat transfer data of all types applicable to any substance.

Physics-Type Laboratories

The heat transfer laboratories at East Kilbride will include physics-type laboratories which will be devoted to fundamental temperature and electrical measurement, determination of thermal conductivities and other related physical properties, and the conduct of small carefully controlled experiments in heat transfer.

There will also be two bays, one of which, the 'intermediate' bay, will be concerned with work of a type intermediate between that of the physics laboratory and the investigations conducted in the other, the heavy bay. The intermediate bay will probably be equipped with a wind tunnel for the study of heat transfer in moving air.

The heavy bay is intended for the testing of H.E. plant. Industrialists having a piece of heat exchange plant which fails to do the work expected from it, or which gives performances exceeding expectations, will be able to send that plant to East Kilbride for

investigation. Its performance will be predicted theoretically in the light of data obtained in the physics laboratory and the apparatus will then be tried out in the heavy bay, in order that the difference between theory and practice may be ascertained.

In general, the activities of the heat transfer division are likely to be concerned mainly with correlation of existing data, measurement of physical properties such as conductivity and viscosity, forced convection for flow over pipe banks with and without fins, convection inside pipes, heat transfer in the presence of condensation and ebullition, heat transfer in the unsteady state, and proof and semi-scale tests of heat exchange apparatus.

In view of the attention which is necessarily being devoted to the requirements of the long-term programme, the actual experimental work on heat transfer has not yet been very great.

University Research Sponsored

Pending the completion of the new laboratories a certain amount of valuable work is being accomplished by sponsoring research at universities. For example, an extra-departmental investigation is in progress at the Imperial College, on the heat transfer of solids in static and rubbing contact, including the effect of lubricants. This problem has important applications such as heat transfer between piston rings and cylinder walls, and the cooling of bearings and gears.

Another interesting extra-departmental investigation is in progress at Queen Mary College (London), in which the mechanism of condensation of a vapour on a cooled surface is being studied with special reference to drop formation. Measurements are also being made of heat transfer during condensation on various surfaces, including the effect of contaminants in the vapour. These subjects are important industrially, since drop condensation is much more efficient than film condensation but is difficult to promote and maintain in practice.

Within the Division, an extensive bibliography of heat transfer literature and data is being collected. A study of the theory of the regenerator is proceeding, and the integral equation arising in the case of parallel flow has been solved. The thermodynamics section has been built up and is still in London. The main objective of this section will be to encourage research on the determination of the thermodynamic properties of technically important gases and to present the results in a form suitable for use in industry. The information is needed for the future development of many industrial and chemical processes and also for heat engines.

Investigation has shown that the properties to be considered are: enthalpy (total heat), entropy, specific and latent heats, free energy function, P-V-T data. These properties are required for some 25 gases, so that the field to be covered is extremely wide. To be successful this enormous task will have to be carried out on a co-operative basis in Britain, and as the scheme develops it is intended to extend it to other countries.

The general procedure is to make critical draft surveys of existing data from which master tables with skeleton versions and tolerances can be prepared. From these bases working tables in appropriate units will be prepared for publication, and these critical surveys will also show what further experimental work is required.

Industrialists are being asked to co-operate by undertaking surveys and placing the results at MERO's disposal. Surveys of the thermodynamic properties of air, carbon dioxide and propane have already been undertaken, and several other surveys are now well advanced.

The completed surveys may be published in full and, if not, will be published in abbreviated form. Research workers interested can obtain copies from MERO and any useful criticisms and comments will be welcomed. Tables of the thermodynamic properties of these substances in a form suitable for use in industry will be made available in due course.

French Interest in Ceylon Company

An agreement has been concluded between a group of Cingalese business men and the French firm Societe L'Air Liquide for the establishment in Ceylon of a Rs. 3 million company. The project would include construction of a factory and import of machinery to manufacture carbon dioxide gas for the production of aerated waters, also to make oxygen, dissolved acetylene, and welding equipment for industrial purposes. Arrangements are being made to train two Cingalese in France to enable them to take technical charge of the factory.

Radio Components Display

Chemistry Helps in Manufacture

THERE were many examples of the value of the chemist's work in the eighth private exhibition of the Radio and Electronic Component Manufacturers' Federation, held at the Grosvenor House, Park Lane, London.

Long-standing difficulties in the production of the valuable metal tantalum are now being overcome and Murex Ltd. were displaying samples of the fabricated metal. The metal powder is converted to massive metal by sintering by a technique similar to that used in tungsten and molybdenum bar manufacture. Current is passed directly through the bars. Provided the tantalum is pure and the sintering properly carried out, fabrication (including forging, rolling, swaging, etc.) is fairly simple as it can be performed in the cold state. When a considerable amount of work has to be done annealling is necessary. Its special interest to chemical engineers lies in its resistance to attack by most chemicals. In this respect it is identical to glass, being attacked only by hydrofluoric acid among corrosive liquids. It is welded satisfactorily to itself and to other metals such as nickel, tungsten and molybdenum. Thermal conductivity is roughly the same as for steel and remains constant as there is no corrosion. Among its miscellaneous chemical applications are for the manufacture of needle valves for water chlorination and spinnerets for rayon manufacture.

An ingenious idea was displayed by Enthoven & Sons for overcoming the difficulties in mass-produced electrical assembly lines in ensuring that all wiring joints can be correctly identified and have been soldered. It is common practice to coat each joint with a coloured lacquer on inspection. Improving on this laborious method of checking, these manufacturers have incorporated a coloured flux in the solder. This indicates and identifies the finished joint automatically. The flux wets the area around the joint and remains as a permanent indicator in the form of a coloured petrified pool on the metal. Super-speed solder with four different colours of core is available. Addition of the colouring matter does not affect the electrical or mechanical properties of the solder.

The first fully insulated Grade 1 spiral resistor of high stability cracked carbon was shown by Erie Resistor Ltd. It is suitable for operation under tropical or other severe conditions. Stability depends, of course, on effective sealing of the surrounding insulator; this range is one where mechanically weak varnishes have been superseded by a ceramic sheath securely sealed at the ends. This improves mechanical strength and stability to atmospheric conditions.

British Moulded Plastics exhibited what was claimed to be probably the largest plastic moulding in production. It was made as a television cabinet and costs less to produce than a conventional wooden cabinet.

By contrast, there was a remarkable featherweight exhibit of the Ever-Ready Co., Ltd., consisting of a dry battery weighing less than half an ounce. This unit, which has an initial voltage of 15 V., uses the conventional cell composition and has achieved this remarkable lightness by mechanical modifications.

The Permanent Magnets Association showed sectional specimens of their new columnar magnets which they are developing to replace the conventional equiaxed ones. By selective cooling, only from the ends, it has been possible to achieve longitudinal columnar crystal formation which greatly enhances the magnetic properties. Using one of their normal Alcomax compositions, they have been able to raise remanence from 12,400 to 13,500 gauss. (BH) Max is up to 7.0-8.0 from about 4.5 and coercivity at 745 in place of 575 oersteds.

Alginic Acid from Seaweed

A project is reported to build a factory at Simonstown, S.A., to extract alginic acid from seaweed. A recent survey of coastal resources shows that there is plenty of brown seaweed. Artificial indoor drying would not be necessary, and most of the essential chemicals for the process could be obtained in the Union. Alginic acid is used for adhesives, food, and in textiles, etc.

Chemical & Dyestuffs Traders Meet

BCDTA Members Realising Value of Their Organisation

THE British Chemical & Dyestuffs Traders' Association held their 28th annual general meeting and luncheon at the Savoy Hotel, London, on Tuesday, 17 April. At the meeting, which took place at 11 a.m., Mr. G. S. Bache was elected president; Mr. C. W. Lovegrove, vice-president; Mr. C. H. Wilson, chairman, and Brigadier C. Norton Stafford, C.B.E., T.D., vice-chairman. Messrs. C. Fountain (Jensen, Lawson & Co., Ltd.), H. Gilliat (E. G. Jepson & Co.), L. S. Heskins (R. W. Greef & Co., Ltd.), and H. R. Peters (J. M. Steel & Co., Ltd.) were elected to the Executive Council. Mr. Ian D. Orr, A.M.I.M.M., was elected hon. treasurer, and Mr. R. Heap, F.C.R.A., was elected hon. auditor.

The following is a summary of the main points contained in the report of the chairman (Brigadier C. Norton Stafford) on the activities of the Association for the past year:—

The excise duty on home-produced hydrocarbon oils imposed by the Chancellor of the Exchequer last year, raised a problem for merchants supplying bonded consumers, but when the position was explained to the Customs authorities, satsfactory arrangements were made which, while protecting the revenue, safeguarded the interests of the merchant.

H.M. Customs to Reconsider

During the year H.M. Customs & Excise proposed to alter the assessment to *ad valorem* duty imposed on imported goods, by computing a flat rate for landing charges, which would be applicable to the whole country. The method of computing the valuation has never been clearly defined, although it had been given effect in the 1932 Agreement, and subsequently in the Finance Act of 1935. The Council were of the opinion that a standard rate for landing costs would be inequitable, and wrong in principle, as it would have the effect of adding to the amount of duty at present payable at certain ports. This view was conveyed to the Customs authorities and following a meeting with all the national bodies concerned H.M. Customs have agreed to reconsider their proposals.

The international negotiations on tariffs and trade were commenced at Torquay in September last and the principal object of the negotiations was to reduce the general level of tariffs. While there are many obstacles yet to be removed, the ultimate attainment of this objective is essential if there is to be any lasting recovery in international commerce.

Objectives Must be Reached

Of greater hindrance to world trade is the absence of a free exchange and the growth of state control by import and export licensing. British exporters have sometimes experienced long delays in receiving payment owing to a shortage of sterling in the buying country. The difficulties are understandable, but it is misleading for a State department to issue an import licence, and receive the currency payment, without indicating that the sterling cover could not be released within a reasonable time. Members will recall that attention was drawn to the delay in sterling remittances from Brazil.

The Open General Import Licence was extended during the year to include a wide range of chemicals and allied materials. Details of the goods which may be imported without a licence from permitted countries were issued to members, and any uncertainty as to the meaning of the regulations or as to the position of any product could be clarified by consulting the Association.

The scarcity of suitable containers, particularly steel drums, has become a serious problem for the chemical trade, and with a view to easing the position, representations were made to the Board of Trade for the import duty on steel drums to be temporarily lifted. An Order removing the duty operates until the end of 1951. Quite apart from the high cost of imported drums it would be unwise for the U.K. to depend on outside sources for supplies of these essential containers and the Association has stressed the need for an increased allocation of steel for the production of drums for the carrying of chemicals and coal tar products.

The present abnormal demand for essential raw materials and its effect on available

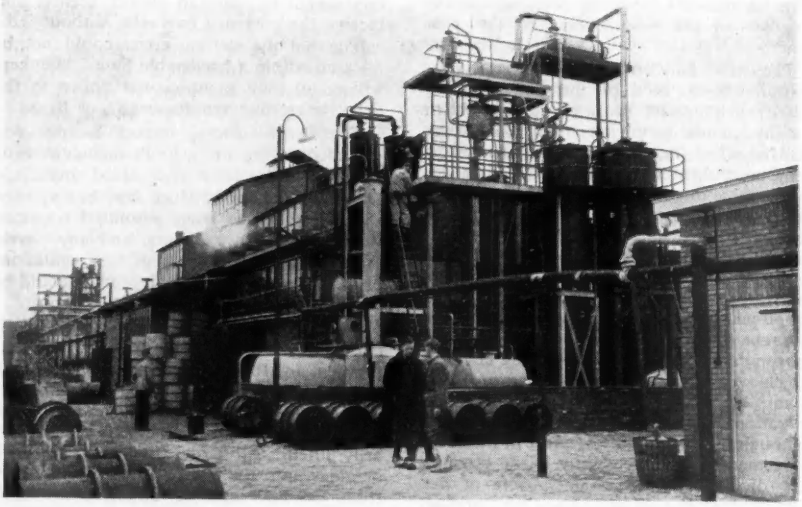
supplies, has drawn attention to the possibility that some of the war-time controls on chemicals may be re-imposed.

It is obvious that in certain circumstances it would be in the national interest to protect supplies of a scarce material needed for essential purposes, and sulphur is a case in point, but the reintroduction of controls in preparation for what might or might not happen would be an unwarranted interference in the proper channels of trade, and it would appear that no official movement in this direction is contemplated. Controls lay the foundation for monopolies and we must not forget that as an association of merchants we speak for private enterprise in the chemical trade, and that it is our duty to oppose monopolies whether they be created by producers, or by a misguided bureaucracy.

Chemicals as raw materials enter into almost all other industries, and it might be timely to emphasise that it is important that the consuming industries shall have access to a free market for their raw materials, for only in a free market can a choice of quality and efficient service be maintained.

The value of the work of the Association as a representative body cannot be overestimated, for it is only by a collective approach to our problems that we can hope to withstand the forces which, unqualified by experience, so often seek to plan the merchant out of existence.

Following a reception by the chairman and president, the annual luncheon took place under the chairmanship of Brigadier C. Norton Stafford. The toast 'The Association,' was proposed by Dr. Charles Hill, M.P., and the president, Mr. G. S. Bache, responded. His Excellency the Right Hon. K. M. Goodenough, C.M.G., M.C., responded to the toast, 'The Guests,' which was proposed by Brigadier Stafford.



An old Dutch fortified town is to-day producing for the fortification of Europe. At Naarden, in the castle region of central Holland, the Naarden Chemical Manufacturing Corporation's chief product is glycerine from which nitro-glycerine is derived for the rearmament of the West. A crucial ten per cent of certain items essential to production, supplied to the chemical plant under the Marshall Plan, put in operation several million dollars worth of capital equipment.

The new unit of the Naarden works pictured here is an " American-type " design with the majority of the equipment outside for safety's sake

New Products at the B.I.F.

Chemical and Allied Trades Well Represented

CHEMICAL and allied trades will again be well represented at this year's British Industries Fair which opens on Monday week at Olympia and Earls Court in London, and at Castle Bromwich, Birmingham.

Olympia will again be the centre of interest for the chemical and allied products, where there will be 61 exhibitors occupying over 24,300 sq. ft. of floor space. Plastics and glassware will be displayed at Earls Court.

In the engineering section at Birmingham a large proportion of the exhibits will be connected wholly or partly with the chemical industry. In the catalogue 26 firms are listed under plant for chemicals and 17 under plastic machinery.

The following are representative of some of the new or modified products which will be on view:—

AUTOMATIC self-priming centrifugal pumps, from 1½ in. to 8 in., with all types of power unit, will be shown by AUTO DIESELS, LTD. A special point is that all the pumps will be close coupled, this making the overall dimensions smaller and the weight lighter.—**Stand Outdoor 1229, Birmingham.**

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CRUSHING plant ranging from giant machines capable of handling 500 tons of coal an hour to small laboratory grinders are included in the range of machines which will be displayed by BRITISH JEFFREY-DIAMOND, LTD. A new laboratory grinding mill for use in the reduction to powder of a wide variety of friable, crystalline, fibrous, resinous and other materials is the Microid Atomill. With a high-speed swing hammer pulveriser it is, however, robust enough for small batch work. All parts are easily accessible, and cleaning by either washing or brushing can be carried out in a few minutes.—**Stand D.526, Birmingham.**

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LEAKS in pressurised systems can be located with speed and accuracy by the Type H leak detector included in its display by the BRITISH THOMSON-HOUSTON CO., LTD. The instrument is portable and compact, and is equally suitable for use in the laboratory or on the assembly line. Its basic principle is the detection and audible indication of the presence in air of parts-per-million of the vapours of the halogenated compounds, such as carbon tetrachloride, trichlorethylene, Arcton (CCl_2F_2). It is claimed as an example of sensitivity that it can at once detect a leakage of Arcton at the rate of 0.02 oz. *per year*. Another instrument of interest to the research worker is the Type G gaussmeter designed for the measurement of flux densities up to 25,100 gauss, which opens up new possibilities in the measurement and investigation of D.C. magnetic fields.—**Stands C.511 and 410, Birmingham.**

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GEARS giving accurate speed control over a wide range, and speed control by hand lever, remote push-button or automatic means, suitable for all industrial purposes will be seen on the stand of CARTER GEARS, LTD. On view for the first time will be a new size of the Carter hydraulic infinitely variable speed gear—the Carter Junior—designed to meet the increased demand for a fractional horsepower unit. This compact, self-contained, fully reversible gear will run at a maximum speed of 1,750 r.p.m.—**Stand D.153, Birmingham.**

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IN the centre of the chemical section, Olympia, a tall lattice mast will mark the stand of THE DISTILLERS COMPANY, LTD. (Industrial Group) where, following the custom of recent years, a number of the subsidiary companies have combined to produce one large display. BRITISH GEON, LTD., and BRITISH RESIN PRODUCTS, LTD., as members of the British Plastics Federation will be seen mainly at Earls Court but a contribution of their products can be seen at the BRITISH INDUSTRIAL SOLVENTS, LTD., exhibit. This company has increased its range of products by the introduction of such cosmetic materials as isopropyl myristate and a number of new ester plasticisers.

The first units of the Grangemouth installation have now been completed and the first products available in bulk will be ethyl and isopropyl alcohols. The progress is illustrated by BRITISH PETROLEUM CHEMICALS, LTD. In marketing in solid form (as

Cardice) the carbon dioxide available as a by-product from the fermentation of molasses and other sources, THE CARBON DIOXIDE CO., LTD., is meeting heavy demands for the chemically-inert material in refrigeration, fire-fighting and a number of other applications.

Pharmaceutical products manufactured by THE DISTILLERS COMPANY (BIOCHEMICALS), LTD., include salts of penicillin and the Distquaine brand range of preparations of procaine penicillin for administration in the form of aqueous suspensions. Since last year the company has marketed buffered penicillin Dc(B)L, which consists of the potassium salt of penicillin admixed with an appropriate buffering agent.

Operations in a typical distillery will form the joint display of the D.C.L. Industrial Alcohol Department and THE METHYLATING CO., LTD., while the work of the Yeast and Malt Extract Department forms a natural corollary to that of the alcohol fermentation process.—**Stands B.5 and 16, Olympia.**

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LABORATORY glassware shown by H. J. ELLIOTT, LTD., includes new and improved apparatus, such as the Elliott differential thermometer (Beckmann type); high precision specification thermometers as used by the oil industry; and new stopcocks introduced on the E-Mil burette range. The E-Mil Green-line measuring cylinder with plastic stopper has been selected by the Council of Industrial Design for the Festival of Britain as representative of the industry. —**Stand D.27, Olympia.**

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FULLERS' earth as used for oil refining, in the textile trade and as a carrier for insecticides, together with products manufactured from this montmorillonitic clay will be shown by the FULLERS' EARTH UNION, LTD. At Olympia the main emphasis will be on activated earths for bleaching oils, fats, waxes, and for catalysts. At Birmingham the main exhibit will be the use of Fullbond for bonding foundry moulding sands.—**Stands B.48, Olympia, and D.117, Birmingham.**

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ELECTRIC ovens for various industrial treatments such as preheating, curing, core-drying, lacquering, enamelling and other drying processes requiring relatively low temperatures will be included in the display by FUNDITOR, LTD. The ovens have automatic temperature control which maintains the pre-set temperature at ± 2°C. within the range of 60-260°C. and 140-500°F.—**Stands F.34, Olympia, and D.324, Birmingham.**

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CONSTRUCTIONAL work for oil and other industries has played an important part in the contribution of G. A. HARVEY & CO. (LONDON), LTD., to the export drive. The manufacture of pressure vessels, autoclaves, fractionating and absorption towers in steel plate up to 3 in. thick and of any diameter and length will be illustrated by photographs.—**Stand B.329, Birmingham.**

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EXPORTS of chemicals and non-ferrous metals and its connections abroad will be illustrated by maps and photographs on the main stand of IMPERIAL CHEMICAL INDUSTRIES, LTD. Details are given of the company's interests in Africa, Argentine, Australia, Brazil, Canada, India, and Pakistan. The Plastics Division stand at Birmingham will be devoted to the uses of I.C.I. plastics in engineering. Stresses set up in various non-ferrous wrought metals during and after welding will be demonstrated by a team from the research department of the Metals Division. Several entirely new drugs will be exhibited by IMPERIAL CHEMICALS (PHARMACEUTICALS), LTD.—**Stands B.9, 11 and 22, Olympia; P.64, X.13 and 17, Earls Court; B.309 and 208, D.409, 308 and 412, Birmingham.**

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TWO entirely new instruments will be shown at Castle Bromwich by LONDEX, LTD. One is the variable on/off ratio process timer and energy regulator (type VM/TS) to control the temperature of hot-plates, electric furnaces, etc. Its longer time ranges make it valuable for reflux and similar cyclic control in the chemical industry. The other is a self-re-setting multi-circuit timer type PR/Roy) used to 'stagger' the starting load of a number of pumps or to begin many processes where a number of operations have to be carried out in a regular timed sequence. **Stand C.722, Birmingham.**

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RIGID laboratory control of production and quality is the principle which is the basis of all the activities of MARCHON PRODUCTS, LTD. This will be emphasised at its exhibit, the main feature of which is a fully equipped laboratory. Analytical techniques used for

[*continued on page 598*

Silica Brick Research

Open-Hearth Deterioration

ALTHOUGH the examination of worn-out silica bricks from open-hearth furnaces represents a study which has extended over generations, further small points come to light as researches continue to be extended. For example, worn-out bricks which are removed after a lengthy period of service, are found to show four different zones, according to the position and temperature which they have been subjected to. The original constitution of the brick is preserved at the outer zone as the temperatures at this point come close to those at which it has originally been burned. The second zone at higher temperatures, and under the action of ferruginous vapours, exhibits the development of tridymite, and reveals a dark brown colour. In the third zone, it is no longer possible to distinguish fragments of the original material with the naked eye, and the mass is quite black. Numerous microscopic crystals of tridymite in a cement of magnetite form the substance of the brick.

Regarding the fourth zone, this contains much less iron than the next above it, and is of a greyish colour. The microscope reveals an entirely new structure here which bears no relation to that of the original brick, and this zone appears to have been so softened that it has reached a viscous disposition. It is apparent from this examination that compared with freshly-burned bricks, highly-burned bricks where the silica for the most part is transformed into tridymite during the burning, produces differences in swelling with the various raw materials. Unlike low-burned bricks, they will not elongate in use, a fact that is well recognised to-day, but which one is the better brick still remains a relative question.

Cause of Deterioration

In the high temperatures which prevail in steel-making, the chief cause of deterioration in siliceous bricks is the swelling, which, due to allotropic modifications of the silica, takes place at these temperatures. A point which has previously been disputed, namely, that open-hearth furnaces on the Continent reach temperatures of 1,750°C. has been confirmed. For such high temperatures, many actual siliceous rocks are unsuitable, and micrographic examination reveals their weakness, since this is largely a matter of structure. Of recent years, this form of investigation has been followed in the large steel works, as well as regularly by brick-maker.

Cemented Quartzite Best

Of the three main kinds of rock, the quartzite where the grains are cemented by a siliceous binder is probably the best. This is relatively rare. Other grits, and certain uncemented quartzites are not of the same value. The cemented quartzites, which formerly largely hailed from Westerwald, are quoted as comprising 96-98 per cent silica, 0.5 to 1.5 per cent iron oxide, 1 to 2 per cent alumina, and traces of lime, but the composition alone is not a true criterion of their value. It is the texture which distinguishes them, as similar compositions can be found in other siliceous rocks. Briefly, the advantage which they possess is that they provide bricks with very little preparation, which otherwise can only be attained by processes of an expensive and complicated nature.

Although quartz, quartzite, flint, grit, and sand can conform more or less to the desired chemical composition, many of these are not suitable. With the exception of certain specific ganisters, grit is not to be recommended, while flint is really not a suitable material. From the point of view of the brick-maker, both of these possess serious defects, as structure is the matter of main importance. Advantage, however, can be taken of rolled pebbles, since the parts which are least resistant to atmospheric action have been worn away by the rolling.

The structure of all quartzites should reveal the grains separated by a siliceous cement in those selected, so as to simulate the Westerwald variety. Edge-runners, which were formerly recommended for breaking-up the material have since been supplanted by improved types of mills, but this is not important as long as a fixed proportion of large grains are left. An appreciable quantity of grains of from 0.04 to 0.31 in. in diameter is necessary, and the final mixture is

recommended to contain 40 per cent of these, with 60 per cent of the fine material. By means of maintaining this ratio of coarse grains to fine, an appreciable influence is made on the swelling of the brick during burning, which is reflected again when the brick is used again in the furnace.

As far as composition of the bricks goes, basic oxides are usually present as about 2 per cent, although poorer varieties have been known to contain nearly 3 per cent, while the alkalis are well below the 0.5 per cent maximum, upwards of 97 per cent silica being present. Added to this in the process of manufacture is a little milk of lime as binding material, but with experience this is reduced to acquire the maximum strength combined with refractory power.

There are several recent developments in the industry. Without entering into the manufacturing procedure, the latest large-scale moulding of bricks takes advantage of the hydraulic accumulator, which provides power to a battery of moulding presses at the minimum expense, although it is doubtful whether these are used to any extent.

In burning, the coarser are the grains, the higher must the temperature be. Briefly, an impalpable powder commences to harden at 800°C., is well advanced at 1,200°C., and may be finished at 1,300°C. With grains of even a fraction of the diameters mentioned, however, the latter temperature is insufficient for the first stage, and 1,450°C. is necessary.

In furnace investigations, efforts have been made to follow the development of the different zone formations by adding materials selected from art enamellers' compositions in minute quantity. This was done by making insertions into the finished brick, and when ultimately dismantled from the furnace it simplified identification. Attempts at adding selected oxides alone, however, to produce a distinctive colour, were not satisfactory. On the other hand, micrographic examination has recently benefited by the use of colour photography in conjunction with polarised light, and is expected to play an important part in making comparisons of the transition points through all stages from the raw material to the final worn-out brick.

Apart from this, another recent development is a special cinematographic camera for studying interiors of furnaces, with appropriate filters, so that areas where softening occurs can be readily identified.

New Products at the B.I.F.

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testing the range of synthetic detergents, surface active agents and emulsifiers, will be demonstrated. A new highly concentrated laundry detergent, Eltesol L. Powder, has been introduced during the year.—**Stand B.7, Olympia.**

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THE manifold applications of nylon in industrial and public service will be depicted in a special section of the display at Earls Court of BRITISH NYLON SPINNERS, LTD. Some of the many uses include nylon fire-hose and safety ropes; filter cloths; metallised nets for radar screens; V-belts; webbing; gas diaphragms; and seed crushing fabric.—**Stands O.213 and 315, Earls Court.**

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BATTERIES for power, supervisory control and switchgear operation will be shown by PRITCHETT & GOLD and E.P.S. CO., LTD. Typical stationary cells of the 'open' and 'closed-top' types will form a prominent feature. They are available in capacities ranging from 10 to 1,080 ampere-hours at the 10-hour discharge rate.—**Stand C.702, Birmingham.**

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A FOUR feet high model of a sulphuric acid adsorption plant, made to 1/12th scale, will be an interesting exhibit shown by QUICKFIT & QUARTZ, LTD. Space limitations prevent the inclusion of full-scale glass chemical plant, but a vacuum still will be displayed with 6-in. bore vapour pipe, a 100-litre electrically heated reaction vessel and a production scale soxhlet extractor. New laboratory apparatus will include: a spinning band fractionating still; chromatographic adsorption columns and assemblies; and climbing film evaporators.—**Stand D.5, Olympia.**

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CHEMICALS, fuel oils, lubricating oil, bitumen and other products will be represented in a comprehensive display by SHELL CHEMICALS, LTD. The main feature will be a cinematographic representation of the action taking place in the catalyst chamber of a catalytic cracking unit used in the manufacture of high quality petroleum. The model catalyst chamber, which is superimposed upon a photograph of the cracking plant, has three windows at different levels through which films show what happens inside.—**Stand B.1, Olympia.**

Post-Restrictions Hangover

Fuelless Outlook for German Industry

THE abrogation of all restrictions on the production of synthetic ammonia, chlorine, styrol, aluminium, synthetic petrol, oils and lubricants by the Allied High Commission and the permission to use all existing capacity for synthetic rubber and butadiene have been welcomed by official quarters in the Federal Republic, but industrial interests express anxiety lest the promised relief should be rendered ineffectual by shortage of coal and difficulties of finance. The shortage of coal and other fuels has created great difficulties in recent months, and while the supply situation has improved of late, it is feared that the Allied High Commission may withhold permission for reopening and repair of synthetic oil plants on the ground that conversion of solid into liquid fuels would endanger the supply of Ruhr coal to European countries dependent on it for industrial purposes.

The Federation of German Industry has already in a memorandum demanded that German factories should have first call on German-produced coal, and this argument is likely to be endorsed by the Federal Government in future negotiations. As, however, the present output of Ruhr coal is hardly sufficient to cover essential needs of neighbouring countries and German industries, the use of coal or lignite for chemical conversions into motor fuels can scarcely be justified on general economic grounds, to say nothing of the change in the relative cost of solid and liquid fuels since the war and the consequently reduced attractiveness of hydrogenation and synthesis on a coal basis to the companies concerned.

Three Plants to Operate

The two hydrogenation works which are now treating mineral oils— at Gelsenkirchen-Horst and Wesseling—will not change their production programme at all, and a third hydrogenation plant—at Scholven—is to resume operations also on the basis of crude petroleum, which will be obtained partly from the Emsland fields in North-West Germany and partly under contract from the BP Benzin- und Petroleum-Gesellschaft, Hamburg. An annual throughput of 400,000 tons of crude oil is anticipated by the Scholven Chemie AG.

Of the six Fischer-Tropsch plants in Western Germany two—at Castrop-Rauxel and Wanne-Eickel—have been in operation, at least for some time, since the war, but even these have met great difficulties, and it is doubtful whether the Fischer-Tropsch companies will find a profitable field for industrial utilisation of their plant under present conditions. Krupp Treibstoffwerke GmbH, Wanne-Eickel, last year received permission to undertake the production of higher alcohols by the Oxyl process. The conversion of the plant to this process, however, has been delayed by financial difficulties which are felt by many other industrial enterprises. The company now seems to have given up hope of carrying out the plan for the time being and will shortly resume the production of Kogasin II (which is used for making synthetic detergents) and hard paraffin. Chemische Werke Essener Steinkohle AG, Bergkamen, intend to operate a new process for the catalytic treatment of coke-oven gas which is reported to yield certain quantities of valuable liquid products.

May be Resumed

The production of buna may be resumed on a limited scale during the summer by Chemische Werke Huels. A monthly output rate of about 500 tons would be feasible, but operations at the previous capacity rate of 15,000-20,000 tons a year will not be possible for another year or two because substantial rehabilitation work will be required. It is claimed that scientific and technical knowledge obtained since the end of the war would possibly justify adjustment of the plant to a new and much cheaper production process.

First reactions to the lifting of Allied restrictions on German chemical production suggest that in present conditions the raw material producers, more particularly the collieries, are not interested in chemical outlets for their commodities, at least not to a pre-war extent. They are not therefore prepared to provide finance for repair and modernisation of chemical plants. On the other hand, there have been several instances

in recent years of producers and users of chemicals co-operating in the erection of new plant because this was the only way in which these users of chemicals were able to make sure of regular supplies. The coal-oil companies affected by the lifting of production hope to receive assistance from prospective customers.

The German fluorspar industry, surpassed in international importance only by the U.S. producers, has been able to derive considerable benefit from increased overseas demand, especially for metallurgical and chemical grades. The United States is now a regular buyer of German fluorspar for the iron industry, and Australia and Japan are other important customers of the German mines. The export demand, however, is largely concentrated on better qualities, with the result that the German producers have encouraged research into new outlets for lower grades. German cement works are reported to have established that use of fluorspar in cement production helps to save coal.

Hope Not Abandoned

Deutsche Bergin AG für Holzhydrolyse which between 1946 and 1949 made an unsuccessful attempt to resume the production of dextrose has not abandoned all hope of operating its Rheinau process profitably. The company states that, though large imports of foreign dextrose and raw material for German dextrose factories forced the hydrolysis plant to close down in 1949, this was due only to the inadequate size and equipment of the plant which was designed for experimental purposes. A larger plant for production on an industrial scale would fare better, in the view of the management. The process, introduced as a means of reducing imports, has, however, little prospect of being developed in present circumstances.

New Insecticide Activator

Dicarboximide Highly Toxic

THE latest addition to the range of insecticide activators or synergists, is N-octyl bicyclo-heptene-dicarboximide or endo-methylene - tetrahydrophthalic - octylimide. The pure material has a boiling point above 150°C. at 2 mm. mercury and a flash point above 350°F. It is an amber-coloured liquid miscible in all proportions with paraffinic and aromatic hydrocarbon solvents and it can be emulsified with water. This activator is able to dissolve by weight approximately 50 per cent of DDT and 35 per cent methoxychlor.

Toxicity Studied in U.S.A.

The toxicity of this dicarboximide has been carefully studied in the U.S.A. and the manufacturers claim that the maximum tolerated dose by multiple dermal application to rabbits is approximately 100 mg./kg. Thus the compound is rather more toxic than either piperonyl butoxide or n-propyl isome. No visceral changes definitely attributable to N-octyl-bicyclo-heptene-dicarboximide were observed in the above animals. At the present stage of the investigations carried out by McLaughlin Gormley King Co., the three compounds are about equal in toxicity when compared on a chronic feeding basis. Rats have tolerated 10,000 parts per million (1 per cent) in the diet for 16 weeks. The toxicity of this new chemical is claimed to be about the same as that of methoxychlor and pyrethrins. In contrast to most phosphoric esters and other insecticides this dicarboximide has no effect on chloline esterase of brain or of erythocytes, like pyrethrins and allethrin.

Some Insecticidal Value

Although when used alone this chemical has some insecticidal value, it is as an activator or synergist that it is likely to prove of the greatest value. With reduced amounts of pyrethrins, allethrin and rotenone the bicarboximide acts as an efficient knock-down agent. The manufacturers say that it may be used economically in aerosols, oil-type sprays, and dust concentrates. It is of the greatest use when combined with allethrin and pyrethrins for roach control in both aerosols and liquid sprays. The high dissolving power of the dicarboximide is calculated to be helpful in aerosols and liquid sprays containing materials difficult to get into solution, such as methoxychlor. With some soluble ingredients, less of the odorous solvents may be used. In aerosol this new activator may be used at ratios of 5 to 15 to 1 with pyrethrins and allethrin. As an example, low pressure aerosols can be made containing 1 per cent methoxychlor, 2 per cent dicarboximide and 0.25 per cent pyrethrins, or 2 per cent DDT, 1 per cent of the dicarboximide and 0.2 per cent pyrethrins.

The Determination of Tungsten

Part II*—Further Gravimetric Methods

TANNIN forms an insoluble addition compound with tungstic acid in acid solution and, at one time, the most popular method for the determination of tungsten in industrial materials involved the use of tannin as precipitant. However, as with most hydrolytic methods, the last traces of tungsten remain in solution, rendering the method unreliable for amounts of tungsten less than 0.5 per cent. Again, considerable co-precipitation errors are incurred. Lambie[26] employed tannin as reagent in combination with antipyrine and added paper pulp as carrier. He obtained satisfactory recoveries of tungsten in the presence of ammonium salts, sulphuric acid and alkali phosphates.

Precipitation with Rhodamine B

During the war, when cinchonine was unobtainable, many alternative reagents were proposed for tungsten, one of the more promising of which was rhodamine B. In fact, the method officially recommended by the British Standards Institution[27] for the determination of tungsten in steels not containing columbium and tantalum, uses rhodamine B as precipitant. The method depends essentially on the reduction of ferric iron to the ferrous state, followed by hydrolytic precipitation of tungstic acid in the presence of rhodamine B; it is not accurate for tungsten contents below 0.5 per cent, low results being obtained.

Precipitation with Benzidine

Benzidine will only precipitate tungsten quantitatively from solutions which are neutral or slightly acidic. In solutions which are stronger than 0.2N with respect to hydrochloric acid Belcher and Nutten[28] found that precipitation of tungsten is incomplete and that co-precipitation of molybdenum is considerable. Von Knorre[29] effected a quantitative separation of tungsten from phosphate in weak acid solution using benzidine as reagent. As with most organic reagents, the composition of the precipitate is not constant and ignition to tungstic oxide is necessary. Henrichsen[30] successfully applied the method to the determination of tungsten in chrome steels, while Dotreppe[31] determined tungsten in ferrotungsten alloys with benzidine as reagent. Hovorka[32] had made a comprehensive study of the analytical chemistry of some benzidine derivatives —*e.g.*, vanillylidene benzidine, *p*-dimethylamino-benzylidene benzidine—and found that all yielded precipitates with tungstate. Quantitative experiments showed that these compounds could be used for the determination of the element in the absence of molybdenum.

Belcher and Nutten[28] have carried out an examination of the analytical chemistry of certain substituted benzidines and related compounds. One, 4-amino-1-(4-aminophenyl) naphthalene was found to precipitate tungsten quantitatively from 1N hydrochloric acid solution. Molybdenum did not interfere. The reagent might prove of value in the determination of tungsten in non-ferrous materials. Ferric iron will oxidise the reagent and must be absent. Although ferrous iron does not interfere, co-hydrolysis and/or adsorption of molybdic acid, which normally becomes very marked in ferric solutions reduced by sulphur dioxide, may limit the scope of the method to some extent. At the present time, there appears to be no satisfactory alternative reductant to sulphur dioxide. Stannous chloride, zinc, and other metals all reduce tungsten. As it is necessary in many industrial analyses to obtain a fully oxidised solution, *e.g.*, to ensure decomposition of complex carbides, the method cannot at the present time be applied to the analysis of steels.

According to von Knorre[29], tungstic acid is quantitatively precipitated by *o*-tolidine in boiling 1 per cent (c.a. 0.1N) hydrochloric acid, while Ubeda and Gonzales[33] claim that *o*-dianisidine (3,3′-dimethoxybenzidine) is a satisfactory precipitant for tungsten.

Precipitation with β-Naphthaquinoline

In recent years, much work has been done by Russian analytical chemists to find a suitable substitute for cinchonine. Golubstova[34] has reported that β-naphthaquinoline is satisfactory and has demonstrated its applicability to the determination of tungsten in steels. The paper has only been seen in abstract, but precipitation of the tungsten is

* *Part I—Gravimetric Analytical Methods—appeared in our issue of 7 April, page 527.*

carried out in 1N hydrochloric acid and good results are claimed for small amounts of tungsten. The steel is opened out in the normal manner, and a 2 per cent solution of the reagent in dilute sulphuric acid is added. The precipitate is filtered off after 15 minutes, washed successively with 1N hydrochloric acid and 20 per cent ammonium nitrate and ignited to tungstic oxide.

The disadvantage of the method is that the precipitate appears to be prone to contamination, in which case a fusion with sodium carbonate, followed by a re-precipitation, is necessary.

Precipitation with Oxine

Oxine (8-hydroxyquinoline) precipitates tungsten quantitatively between *p*H 4.95 and 5.65. In cold solution the composition of the precipitate varies with acidity, but Otero and Montequi[35] claimed that a precipitate of composition $(C_9H_6ON)_2WO_2$ is obtained when precipitation is carried out in hot solution. The precipitation is effected in neutral or slightly alkaline solution using boiling 4 per cent ethanolic oxine as reagent, and the acidity is then adjusted with acetic acid. If the precipitate is dried at 120°C., it contains 36.5 per cent tungsten. It is important that the tungsten solution be acidified *after* the addition of the reagent, otherwise complex polytungstates are formed which prevent complete precipitation. Gulek and Rysanek[36] precipitated tungsten with oxine from a solution containing oxalate and ammonium acetate and ignited the precipitate to tungstic oxide at a temperature less than 420°C.

Mukhina[37] has compiled a useful review of the application of oxine to the analysis of steels and alloys.

Precipitation with Pyramidone

Gusev and Kumov[38] have used pyramidone as a tungsten precipitant, a theoretical recovery of tungsten being obtained after a 12-hour stand. These workers used ammonium tungstate solution as their synthetic solution and their method of determination is briefly as follows: 10 ml. conc. HCl are added to 140 ml. of $(NH_4)_2WO_4$ solution containing 0.01 g. WO_3. The solution is boiled, allowed to stand for 12 hours and filtered through paper. The precipitate is washed with 0.5 per cent pyramidone in 2 per cent HCl, and ignited to WO_3.

Certain tungsten-containing materials are difficult to dissolve, but Gusev and Kumov found a mixture of 30 per cent hydrogen peroxide and saturated oxalic acid to be satisfactory in most cases.

Goryushina and Cherkashine[39] confirmed the usefulness of this solvent, although they employed a titrimetric method to determine the tungsten.

Precipitation with Yoe's Reagent

In 1945, Yoe and Jones[40] recommended the compound anti-1,5-di(*p*-methoxyphenyl)-5-hydroxyamino-3-oximido-1-pentene as a reagent for tungsten. The complex formed with this compound and tungsten is virtually insoluble in water. It will precipitate tungsten completely from 0.5N solution, but molybdenum is co-precipitated to some extent at this acidity. At higher acidiities solubility losses are incurred. Steel chemists have found the reagent unsatisfactory. Other reagents examined by Yoe and his coworkers were cinnamal-anisal-acetone oxime and dianisal-acetone oxime[41]. Both reagents precipitate tungsten as a bright yellow precipitate and are claimed to be satisfactory for the gravimetric determination of tungsten and to be specific for the tungstate ion.

Precipitation with Miscellaneous Organic Reagents

Cumidine has been used by Kafka[42] to determine tungsten gravimetrically. The reagent was a 5 per cent solution in 5 per cent hydrochloric acid and the precipitation is effected from neutral solution with a standing time of 1 hour. The tungsten is weighed as tungstic oxide after ignition of the precipitate. Molybdenum will interfere under the conditions employed.

α-Naphthylamine gives with tungstate a precipitate of composition $(C_{10}H_9N).5WO_3.3H_2O$.

Tschilikin[43] has used the reagent in dilute hydrochloric acid to determine tungsten.

Phenylhydrazine has been suggested by Dotreppe[31] for the gravimetric determination of tungsten. Precipitation is carried out in 8N hydrochloric acid, but it would seem that the last traces of tungsten remain in solution. In other words the precipitation appears to be entirely hydrolytic.

Kafka[42] employed tetramethyl-4,4′-diamino-benzophenone as precipitant, but it has not been widely adopted. Similarly, the related compound tetramethyl-4,4′-diaminodiphenylamine, with which Kafka claimed

quantitative precipitation of tungsten, has not met with favour.

α-Benzoin oxime has been examined by Feigl[44] as a tungsten precipitant, and Yogoda and Fales[45] have used the reagent for the determination of tungsten in molybdenum steels. The method is tedious as it involves a separation of molybdenum from precipitated molybdic and tungstic oxides.

Gutbeir and Weise[46] described the use of 'nitron' for the separation and determination of tungstate. The precipitation is carried out in acetic acid medium, and on the whole appears quite unattractive.

Prontosil—the first sulphonamide drug—is claimed by Fomin[47] to give a quantitative precipitation of tungsten in dilute nitric acid. In more acid solution the precipitate is somewhat soluble, which renders the method useless for most practical purposes.

Grimaldi and Davidson[48] described a procedure for the determination of tungsten in ores using the alkaloid brucine as precipitant. Precipitation is claimed to be complete, but a correction must be made for molybdenum.

Totaquine has also been recommended as a tungsten precipitant. Phillips[49] determined tungsten in acetic acid solutions of alkali tungstates, but encountered considerable coprecipitation from molybdenum and, when alkali sulphates were present, high results were obtained.

Inorganic Precipitants

There have been only a few inorganic precipitants recommended in the literature for the determination of tungsten. The main drawback to their widespread use appears to be their non-selectivity.

Precipitation as Mercury Tungstate

The precipitation of tungsten as insoluble mercurous tungstate has long been known. The precipitate may be ignited and weighed as tungstic oxide after volatilisation of the mercury. In a recent paper, Wirtz[50] has pointed out that tungsten is best precipitated with an acid solution of mercurous nitrate, without subsequent addition of alkali, as the latter promotes formation of soluble metatungstates. Incomplete precipitation occurs in strongly acid solution. Yosida[51] found that the temperature of ignition must exceed 680°C. to ensure complete volatilisation of the mercury. Cloke[52] used the mercurous nitrate method for the determination of tungsten in wolfram ores: a 0.1 g. sample was dissolved in 35 ml. of 30 per cent sodium hydroxide, treated with sodium peroxide to destroy sulphides and the solution partially neutralised with 5N nitric acid. After removal of tin, the solution was made alkaline with a solution of ammonia, a 10 per cent solution of the reagent added, and the solution boiled for 10 minutes before filtration.

Blumenthal[52] described a method for the determination of tungsten based on precipitation with mercuric nitrate. The initial precipitate of mercuric tungstate was coloured brown, due to the formation of some mercuric carbonate. Nitric acid was added until the precipitate became white and the solution was boiled and treated with 2 per cent sodium hydroxide until a permanent precipitate of yellow mercury oxide was obtained. At a *p*H of 3.5, precipitation of tungsten was complete and no hydrolysis of the reagent took place. The precipitate of mercuric tungstate, which contained a small amount of mercuric oxide, was filtered and washed thoroughly with hot water until the filtrate showed no trace of mercury on passing hydrogen sulphide. The tungstate was ignited to the oxide at 800°C., and weighed.

Precipitation as Barium Tungstate

In 1943, de Witte[53] examined the possibilities of determining tungsten gravimetrically as the insoluble barium tungstate. He claimed that the method he developed was superior to the cinchonine and mercurous nitrate methods. Like most other methods for the determination of tungsten, it appears that the precipitation should be effected in neutral solution in order to obtain quantitative recovery of tungsten. The precipitate was ignited at 750°C. and weighed as $BaWO_4$.

More recently, Ubeda *et al.*[54] have described two procedures for the determination of tungsten based on its precipitation as barium tungstate. In the first method, the tungstate is precipitated from hot, slightly acid solution with 2N barium chloride, and, after filtering and washing, the precipitate is ignited to $BaWO_4$ and weighed. Good results are claimed. In the second method, 0.1N barium chloride is used as precipitant, and after filtering off the precipitate of barium tungstate, the barium is determined in the filtrate as $BaSO_4$. The method is not

as rapid as the former, but avoids carbonation better.

(To be continued)

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Inorganic Luminescence

Sensitivity to Presence of Impurities

LUMINESCENCE in Inorganic Chemistry was the subject of a paper read by C. G. A. Hill, B.Sc. (Phillips Electrical, Ltd.), at a recent meeting of the London and South Eastern Counties Section of the Royal Institute of Chemistry held at Reading University.

Inorganic luminescent materials are essentially transformers—absorbing short wavelength energy and emitting photons of longer wavelength. The most important physical properties that can be measured are the absorption, excitation and emission spectra, the quantum efficiency and the kinetics of the storage of energy by phosphorescent materials.

The chemical characteristic that all inorganic phosphors are extremely sensitive to the presence of traces of impurities leads to the conception of 'centres' within the host lattice at which energy may be absorbed, stored, emitted or degraded into heat. The chemist's task is the identification of the chemical constitution of these centres.

In the case of zinc sulphide, which forms the base of the most important series of phosphors, this task is only partially complete. Kröger has shown that the fluorescence centres in the case of phosphors activated by zinc, silver and gold are probably monovalent cations on substitutional lattice sites. The charge compensation can be obtained by the simultaneous incorporation of Cl^-, Br^- or I^- on sulphur sites or of a trivalent cation (for example Al) on zinc sites.

Copper-activated zinc sulphide is more complex as two distinct emission bands can be obtained with this activator. One model that appears to satisfy the observed behaviour ascribes the green copper emission to Cu^+ on zinc sites and the blue emission to an association between a green centre and a copper atom.

The insight gained by luminescence studies of the chemistry of the inside of a crystal lattice may prove to have applications in the wider field of solid chemistry.

In the discussion which followed, Dr. Glimbleby asked whether the emission spectrum of luminescent solids was sufficiently characteristic of the activating element to enable the element to be identified. Mr. Hill confirmed that this was so under standard conditions. In answer to Mr. Radley, the lecturer said that grinding zinc sulphide does not really destroy active centres but introduces 'killers', that strains can act as 'killers' and that re-heating to 1,000°C. causes re-luminescence. Replying to Mr. McLachlan, Mr. Hill said that oxygen enters into the luminescent properties of calcium sulphide.

Others taking part in the discussion were: W. A. Chitson, C. W. Herd, J. W. Granville, and H. J. Tabor. The vote of thanks to the speaker was proposed by Col. Hussey. Dr. C. W. Herd was in the chair.

Plastics & Printing Industry

EXAMPLES of its latest work in laminated and extruded plastics and appliances for the gas industry will be included in the private exhibition of its products to be held by Thomas De La Rue & Co., Ltd., at the galleries of the Royal Society of Painters in Water Colours, London, from 2-19 July.

This is the first occasion that the company's varied activities have been brought together in one display.

Exhibits of historical interest from its own museum will help to tell the story of the firm's development from early Victorian times, and among the articles shown will be several which were at the Great Exhibition of 1851, when the business had already been in existence for nearly 40 years.

BEPO at Harwell

First Full Details of Large Pile

THE first detailed description of the construction and composition of Bepo (British Experimental Pile), the larger of the two piles at the Atomic Energy Research Establishment at Harwell, has recently been issued by the Ministry of Supply.

The fundamental design of Bepo was undertaken by the U.K. staff working at the Montreal Laboratory in Canada during 1945-1946, and work was begun on the project early in 1946. In two years the work was sufficiently far advanced for the plant to be handed over to the Harwell Research Establishment for final tests and operation.

Bepo is a graphite-moderated, air-cooled pile with a central thermal neutron flux of 10^{12} neutrons/cm²/sec., a critical loading of 28 tons of uranium metal, and a full uranium load of 40 tons giving rise to an excess reactivity which can be used for producing isotopes or for experimental purposes. The air cooling system was designed to limit the maximum surface temperature of the fuel elements to 200°C. Loading to critical size took place on 5 July, 1948, the uranium being added channel by channel until the reaction became divergent. The power of the pile was continuously monitored in the sub-critical state by specially made measuring instruments and when the pile diverged, the power was permitted to rise to 50 watts, with no coolant flowing, before the reaction was shut down by the automatic safety system. This was followed in the ensuing months by a gradual work up to full power, the design maximum flux being reached by the Christmas of 1948.

Cooling Measures

A considerable volume of air is required to cool the pile (about 180,000 cu. ft. per minute) and this is drawn through the pile, in a single pass system, by a number of exhausters situated between the pile and the main exhaust stack. Filters are installed in the air intake to clean the air before it is passed through the pile and another set is between the pile and the compressors to remove any trace of radioactive dust which might arise in the pile itself before the air reaches the main machinery, which discharges into the base of a 200-foot high stack.

Since materials introduced into the pile are radioactive on removal there is within the pile building a concrete storage block with accommodation for some five tons of irradiated uranium cartridges (usually called 'slugs') and numerous other cells where irradiated materials can be stored temporarily on removal from the pile until they have decayed sufficiently for safe handling. Irradiated material from the pile has to be withdrawn direct from the pile into lead flasks and a feature of the pile building is the overhead crane system to permit of the easy handling of these heavy flasks.

Reactor's Construction

As regards construction, the reacting part is a cube of graphite of 26-foot side through which pass 1,849 channels about 3¼ sq. in. in cross section and pitched at 7¼ in. centres. The central 900 of these channels can accommodate bars of uranium machined into cylindrical rods, 12 in. long by 0.9 in. diameter, encased in aluminium to prevent oxidation of the uranium and the escape of fission products into the cooling air stream.

Twenty uranium bars are included in each channel leaving 3 ft. of empty channel at each end. The channels are loaded radially outwards from the centre to form a right cylinder of 10 ft. radius and 20 ft. long. The remainder of the graphite around this central core serves as a reflector to neutrons which would otherwise escape from the central system.

In addition to the main channels this graphite moderator is perforated with holes for experimental purposes so that the actual structure is somewhat complicated. It is built up of standard blocks each 7¼ in. by 7¼ in. by 29 in. long with features machined in their surfaces which provide when assembled all the necessary holes. 850 tons of graphite required machining into some 25,000 blocks with more than 60 variations in the basic types, and this work was executed in a workshop specially erected for the purpose at Harwell. The general machining tolerance adopted was ± 0.0025 in. on all dimensions and such accuracy was maintained that the total height of the 26-ft. completed stack was correct to within

0.03 in. From the top and one side, cubes of graphite, 'thermal columns' project from the main moderator. These columns by virtue of their distance in graphite from the nearest source of fast neutrons provide a source of almost pure thermal neutrons.

The 900 central channels are connected at both the air inlet and air outlet ends by headers 4 ft. wide and extending over the whole graphite face. The headers are connected to the 10 ft. by 8 ft. underground ducts of the main air system. The main outer structure of the pile consists of a reinforced concrete and steel shell lined with 6-in. thick cast iron plates, and constitutes the biological shield for attenuating the intense radioactivity within the pile.

Large Attentuation

The 6-in. cast iron shield provides an initial large attentuation of thermal neutrons and gamma rays so that the bulk of the radiation energy escaping from the reflector is converted into heat in a conducting and heat-resistant material from which it can easily be transferred to the cooling air stream circulating past the sides of the cast iron, so avoiding high temperatures in the concrete.

When the graphite moderator was stacked, stringent precautions were taken to ensure clean conditions, so as to exclude dust and other impurities with high capture cross-section for neutrons which might prevent the pile reacting. To obtain these conditions (not usually available on a construction site) the shield was built as a complete box, the air ducts and all holes through the shield sealed off, the inside of the pile meticulously cleaned and lightly pressurised with clean air before graphite stacking was started. The entire shield therefore had to be constructed as a unit and one of the problems in the construction of the pile was the extreme accuracy with which the pile shield comprising some 3,000 tons of concrete and 600 tons of steel had to be assembled in order that continuity and alignment of the 3,800 holes common to both graphite and shield was preserved.

The pile is loaded by pushing in a row of slugs from the charge face of the pile, and unloaded by means of steel push-rods which push the irradiated uranium slugs out through the unload face into a lead-shielded container. A bridging section is provided connecting each uranium air channel with a hole through the shields so that the uranium bar can cross the air headers. The holes through the shield are, of course, plugged to prevent the escape of radiation at all times other than when an individual channel is being loaded or unloaded, and all holes through the shield are stepped so that no direct path is provided for escape of radiation. Loading and unloading machines are carried on 12-ton hydraulic hoists extending the width of the pile and can be positioned accurately to any horizontal row of shield holes on the load and unload faces of the pile and traversed on the hoists to select the requisite hole in a given horizontal row.

As explained earlier the pile is cooled under induced air draught which was preferred to forced draught in order to establish a negative pressure within the pile with respect to atmosphere, to ensure that any leakage of air at the many holes through the shield wall would involve fresh air inwards and not activated air or dust outwards.

The pile is controlled by introducing four boron-carbide-filled hollow steel rods 2 in. in diameter horizontally into the side of the pile so that, when fully inserted, the rods extend across the reacting core. These rods can be accurately positioned from push buttons in the control room. In addition there is a second system of ten similar rods, known as shut-down rods operating vertically in the pile and having two positions only, right in or out. When both systems are fully inserted, the fission rate within the pile is about a milliwatt since the boron in the rods absorbs thermal neutrons very strongly. The start up procedure is first to withdraw the shut-off rods, then the control rods to a position where it is known that the pile power will rise at a reasonable rate; when the desired power is reached the rods are moved in until the indicated power level is steady.

New Drying Oil at B.I.F.

A new range of oil additives with full technical details will be exhibited by the WATFORD CHEMICAL CO., LTD., which will also be showing a synthetic drying oil for the paint industry claimed to be equal to tung oil in its drying and film forming properties. The main feature of the display will be the main compounds which will be enclosed in an atomic model of their basic molecular structure, with each hydrogen, carbon and oxygen atom enlarged 6,400 million times.—**Stand B.33, Olympia.**

THE MODERN SOAP AND DETERGENT INDUSTRY, VOL. II. By G. Martin, D.Sc., Ph.D., F.R.I.C., Third Edition. Revised and enlarged by E. I. Cooke, M.A., B.Sc., A.R.I.C. London. The Technical Press Ltd. 1951. 397 pp. + 50. 50s. net.

The first volume of the third edition of Dr. Martin's book was reviewed in the issue dated 13 January of this journal. The second volume has just been published and its subject matter is 'The Manufacture of Special Soaps and Detergent Compositions.' It discusses toilet soaps, shaving soaps and creams, tooth-cleaning compositions, pharmaceutical, medicated, and disinfecting soaps, textile soaps, chipped and flaked soaps, soap powders, abrasive and polishing preparations, soft soaps, hydrocarbon and protein soaps, soap substitutes, leather and furniture polishes, and synthetic surface active materials.

The method of approach is logical; the requirements or essential properties of the product are first discussed, and then various processes of manufacture are described in detail and a comparison is made between their outstanding features. Then an attempt is made to show how their products conform with the specification outlined at the beginning of the chapter. Not only are the processes dealt with in principle and from a theoretical standpoint—a treatment which must be of great value to the manufacturer—but in addition practical formulations abound throughout the book.

Some of these formulations are most inviting: in Chapter X on the 'Old French Process of Toilet Soap Manufacture,' there is, for example, a description of Lettuce Soap. The first step in the preparation of this aristocrat of soaps is to melt lard with its own weight of lettuce leaves and to keep the mixture at 90°F. 'until the leaves have parted with their colour and their juice.' Lettuce soap! What could be more fitting to cleanse and cool the jaded skin after a hot and tiresome journey? The chapters on soaps of all kinds are excellent and very thorough, although it must be added that the treatment of the early processes is very much more detailed and lengthier than that of more recent work. The references, too, are much more frequent to early than to later work, and the abominable system of page numbering persists, e.g., lettuce soap is described on II, 1, 80. Nevertheless, as a text book on *soap* the book is excellent; the mass of practical and theoretical knowledge that has been packed into this book must for the soap manufacturer and merchant be of inestimable value.

This second volume incorporates also the treatment of the synthetic detergents; these have made almost their whole progress since the second (the last previous) edition of Dr. Martin's book was published in 1931. They constitute a new and valuable class of compounds which have become of great importance in industry, and which are increasingly used in the home. It had accordingly been hoped that they would have received adequate treatment; a book which did deal with them adequately would be of considerable use to users of detergents as well as to the makers. To-day it is likely that some of the modern synthetics will continue to be sold not only in liquid form, but also perhaps soon in solid form. In any case, their use has grown tremendously and will probably continue to do so. Unfortunately the treatment of these synthetics is anything but adequate. Thus, Lissapol N, probably the most widely used of the non-ionic detergents, has to share a half page with other members of its class which are of importance only in other countries, and then of an importance mainly historical. No indication is given that Lissapol N and Teepol are the two most widely used synthetics in the United Kingdom. No mention is made of the behaviour of Lissapol N solutions on warming, of the *lower* solubility of Lissapol N in hot than in cold water. Teepol, too, receives only scant treatment and Iensex, is not even indexed. There are many advantages that

such detergents possess over soap, and there are some problems, notably of sewage disposal, which they bring in their train. It is impossible to avoid the feeling that Mr. Cooke has missed a golden opportunity of describing and giving a critical assessment of the properties of the new synthetic detergents—one which would have been of value to the technicians of many industries.—R.W.M.

CONDUCTIMETRIC ANALYSIS AT RADIO FREQUENCY. By G. G. Blake. Chapman & Hall, London. 1950. Pp. xvi + 109. Figs. 40. 15s.

This book is subtitled 'A New Technique for Titration (Including a Chapter on Moisture Meters.)' It is stated that the work formed the subject of a lecture before the New South Wales Division of the Australian Branch of the Institute of Physics in 1947. and the majority of the 95 references listed indicate publications of the author in a variety of journals.

In this present time of paper shortage, the contents of the book, purporting to present a new method of analytical chemistry, would, one might have thought, been more satisfactorily presented as one or two concise papers in one of the more reputable journals devoted to analytical research. The reputation of the method generally will not stand or fall by what the author has to say about it here, but by the success with which other workers are able to apply and extend it.

It is doubtful if many workers will be induced to apply the method merely because of the present account of it. The book is a confused presentation, split up into small sections, each with its own sub-heading, of a heterogeneous mass of material. The narrative is diffuse, and deals with the inception of the method, electrical circuits, procedures, actual and possible applications, and what, for want of a better term, one may call 'gadgets.' No indication is given by the 'founting' as to which are important sub-sections and which are minor. Thus, the sub-headings of sections 47-51 read: "Microburette versus Dipper.' 'Small Liquid Drops.' 'Assembly of the Conductimetric Tube.' 'Graphs on Frosted Glass (Graphtablet).' 'Determination of the Temperature Coefficient of Conductivity of Aqueous Solutions (Rectified Radio-frequency Method.)' There is nothing by which one may judge which of these are side-issues (as some of them are) and which are in the main current of the argument. Again, in the chapter on applications, Section 83 is headed 'Zoology', and reads: 'In Zoology the author's methods have been suggested in the investigation of small organisms in water.' This is not an isolated example of the wasteful device of one sentence per caption.

Throughout the book one gets the impression that the author is rather obsessed by priority claims, and is therefore at pains to stress his own claims and to include every idea that might at some time develop or be developed.

Although there are less than 100 references, these are in many cases incomplete as regards dates and page numbers, and in at least two instances which happened to be familiar to the reviewer, inaccurate. Proof reading has not been as careful as it might have been.

The technique described will hardly, by its presentation here, fulfil the hopes expressed by the publisher on the dust cover of making 'a substantial contribution to the methods of analysis at present used.—C.L.W.

Dechema Information Meeting

INVITATIONS are being sent out for the Dechema Information Meeting 1951 which will take place in connection with the yearly session of the Chemical Engineering Committee of the Association of German Engineers in Frankfurt-am-Main from 27-30 May. The meeting will serve to promote the technical and scientific development of chemical equipment and engineering and the co-operation of chemist, engineer and physicist, of science and practice, and of the experts of all countries. So far, scientific meetings have been devoted solely to lectures and discussions in full assembly. Personal discussions were left to chance. But such technical-scientific discussions between two men or in a small circle are often really useful. It is the characteristic feature of an Information Meeting to prepare systematically such individual discussions and render them possible. Experts of about 200 manufacturers of chemical installations and equipment for science and practice will be at their stands for conference purposes during the four days of the meeting. Its importance is emphasised by a comprehensive programme of lectures.

· PERSONAL ·

SIR ARCHIBALD FORBES was last week elected president of the Federation of British Industries on the retirement of SIR ROBERT SINCLAIR who has held the office for two years. Sir Archibald, who is 48, is a director of Spillers, Ltd., and chairman of the Debenture Corporation. From the time of its inception in 1946 to its termination three years later he was chairman of the Iron and Steel Board, which consisted of representatives of both sides of the industry and independent members. He has a long record of public service including from 1940-1945 the holding of various appointments at the Ministry of Aircraft Production and the posts of deputy-secretary and member of the Aircraft Supply Council.

Newman Industries, Ltd., Electric Division, announce the appointment of MR. H. MCCONCHIE as branch manager of their new branch office situated in Russell Chambers, 54 Merrion Street, Leeds. Mr. McConchie was previously with Messrs. George Ellison, Ltd., H.V.E. (Electrical), Ltd., Brandon Electric Co., Ltd., and Thomas Smith & John Brown, Ltd. He is a past-chairman of the Leeds branch of the Association of Supervising Electrical Engineers.

Two appointments for the Edmonton, Alberta, plant of Canadian Chemical Company, Ltd., were recently announced by Harold Blancke, president of Celanese Corporation of America. MR. VINCENT ANWYLL, chemical engineer of the Bishop, Texas, chemical plant of Celanese Corporation of America, will become plant manager. He has been production manager at the Texas plant and previously held a key position at the Cumberland, Maryland, works, which produce cellulose acetate as well as cellulose acetate yarns. MR. J. GORDON MITCHELL, chemical engineer at Cumberland, will become plant engineer of the Edmonton operation. He has been with the company since 1929.

MR. H. S. REID, of Montreal, a director and since 1927 a vice-president of Shawinigan Chemicals, Ltd., has been appointed executive vice-president and MR. E. R. WILLIAMS, of Shawinigan Falls, Que., has been elected a director and appointed vice-president in charge of manufacture.

Mr. H. S. Reid

Mr. Reid, born in Scotland, came to Canada as a child with his family. At McGill he received his bachelor of arts degree, and then his master of science and the governor-general's gold medal for research. After a brief period with Canadian Consolidated Mining and Smelting in British Columbia, he joined the Shawinigan organisation in 1915 as a research chemist with Canadian Electro-Products Company, and was general manager of that company by 1927 when it became the chemicals division of Shawinigan Chemicals, Ltd.

He is a vice-president of Canadian Resins & Chemicals, Ltd., and a director of Shawinigan Products Corporation, New York, and of Shawinigan Resins Corporation at Springfield, Mass.

Mr. Williams, a graduate of the University of Toronto, joined Shawinigan in 1915, with Shawinigan Electric Metals. He spent four years with the Canadian and Imperial armies during World War I and, returning to Canada, entered Canada Carbide Company, which in 1927 became the carbide division of Shawinigan Chemicals, Ltd. In 1942, Mr. Williams became works manager, in charge of all divisions of the company's plants at Shawinigan Falls.

Obituary

The death was reported last week, at the age of 58, of MR. HARRY DAVIES, technical manager of the I.C.I. Metals Division at Landore, Swansea, since 1938, and former lecturer in non-ferrous metallurgy at the Technical College, Birmingham. In 1946 he was elected a Fellow of the Institute of Metallurgists.

HOME

Chemical Engineers Examination

Particulars of the 27th Associate Membership Examination of the Institution of Chemical Engineers may now be obtained from the hon. registrar. Application forms should be returned by 1 June 1951. Written and oral examinations will be held in September. Home papers will be issued in January 1952.

British Ceramic Society

The spring meeting of the Refractory Materials Section of the British Ceramic Society is being held at the Royal Victoria Station Hotel, Sheffield, from 6-7 June. Papers scheduled for presentation include: 'Low-alumina silica bricks for open-hearth furnace roofs'; and 'Trials of refractories in steel plants.' Several works will be visited during the session, including those of the Steetley Co., Ltd., J. J. Dyson, Ltd., and Steel, Peach & Tozer. A discussion will be held on the Thursday morning on the foreign impressions of several members.

New Premises

Stordy Engineering, Ltd., thermal and mechanical engineers and makers of furnaces, industrial ovens and metal finishing plant, have moved to more commodious premises. The new address is Cumbria House, Goldthorn Hill, Wolverhampton. Telephone number is Wolverhampton 37341-2.

Export Licence Changes

The Board of Trade announce that as from 16 April, licences are now required for exports to all destinations of mixtures of specified abrasives; iron and steel in various forms; some types of used steel; manufactured cotton cleaning waste; and certain drugs and chemicals. Licences will also be required, for the export to all countries except the Commonwealth, Irish Republic, and U.S.A., of some types of precision and electronic instruments, and of some types of mineral separation plant. Included in the list of chemicals are: sulphur dioxide and its derivatives, acetone metal bisulphites, aldehyde metal bisulphites, dithionites (hydrosulphites), metabisulphites (bisulphites) sulphites, sulphoxlates, sulphurous acid, thiosulphates, and mixtures consisting mainly of one or more of these materials.

Steam Headers Six-day Journey

Two special 56 ft. fusion welded steam headers, manufacturer by Babcock & Wilcox, Ltd., provided traffic problems when they were recently transported by road from the maker's works at Renfrew, Scotland, to Billingham—a distance of 188 miles. The headers, which are extraordinary in size, are unique in the number of connections that are welded to the barrel. They were ordered by Imperial Chemical Industries for the distribution of steam to various parts of its Billingham works. The journey took six days. Each header weighs 14¼ tons and has an internal diameter of 42 in. They are suitable for superheated steam at a pressure of 275 p.s.i. and a temperature of 662°F. (350°C.).

Fertiliser Price Increases

The Board of Trade have made an order effective on 16 April, 1951, which provides increased maximum prices for (a) all fertilisers in Great Britain other than muriate and sulphate of potash, but including compound fertilisers and (b) all fertilisers in Northern Ireland other than muriate and sulphate of potash, ground prosphate and compound fertilisers. The increases in price will be 3s. 6d. per ton for triple superphosphates, 'Nitro-Chalk' and concentrated complete fertilisers; 3s. per ton for sulphate of ammonia; 2s. per ton for basic slag; and 1s. 9d. per ton for compound fertilisers, ground prosphate and superphosphates. The increases are due to yet another of the periodic increases in rail freight charges.

Tanker-Building Programme

The world's largest oil tanker building programme since the war has been put in hand by Shell at a cost in the region of £45 million. This was announced in London recently by Sir George Legh-Jones, M.B.E., managing director of the Anglo-Saxon Petroleum Company. The programme consists of tankers specially designed to carry over ocean routes the Group's expanding oil trade and provides for 41 general purpose tankers of 18,000 tons deadweight of entirely new design, and 5 supertankers of 28,000 tons deadweight—a total of nearly 900,000 tons (d.w.) of new construction. This single programme is nearly equal to the total tonnage owned by the Shell Group in 1930.

OVERSEAS

Indian Fertiliser Plant

Completion of the fertiliser factory at present under construction at Sindri is expected by about the middle of this year, and it is planned to start production as soon after as possible. Capacity of the plant—1,000 tons of ammonium sulphate per day—will, it is hoped, be reached by March next year. Action is now being taken to implement the decision to transfer the management to a private limited company in which the Government would hold a majority of shares.

High Pressure Impregnation of Timber

Shortages of durable timbers in Australia for use as rail sleepers, and cross arms, have led to investigations by the Forest Products Division of the Commonwealth Scientific and Industrial Research Organisation into processes for timber preservation by high pressure impregnation. Normally the pressure-treating plants operate at 200 lb. per sq. in. This, however, is not adequate for the treatment of Australian hardwoods—and in many cases the resulting penetration is negligible. Experiments in the division have shown that with pressures of 1,000 p.s.i. good absorptions can be obtained with many species of eucalypt. The division has now built a pilot plant to treat several thousand sleepers for service tests of the process.

Austrian Sulphuric Acid Plant

The new sulphuric acid plant, built by the Bleiberg Mining Union, Ltd. at Gaütz, Carinthia, in the British zone of Austria, is to start operations shortly. Annual production will at first be approximately 16,000 metric tons, but it is hoped to double this output by the autumn of this year. The new plant will help to reduce imports of sulphuric acid to Austria for which some 70,000 metric tons are estimated to be required annually while her present production is only about 7,000 tons.

South Africa's First Refinery

Further information is now available regarding the construction by the Standard Vacuum Refining Co., of South Africa (Pty.), Ltd., to be constructed at Wentworth, Durban, at a cost of approximately £4.5 million. It is expected to begin operating late in 1953 or early the following year and will process more than 125 million gallons of crude oil annually. The refinery will be a combination unit in which a fluid catalytic cracking plant will be directly linked with crude fractionating and thermal reforming facilities.

Phthalic Anhydride in Canada

Plans for an addition to its Toronto works have been announced by the Dominion Tar & Chemical Co., Ltd. Work is to begin soon on a plant for the production of phthalic anhydride, used in the plastic and paint industry. The new plant will contain 60,000 sq. ft. of floor area and is expected to cost over $500,000.

Ceylon Fertiliser Project

A comprehensive survey of the North Central Forest Division is being carried out in Ceylon by a team of three experts to advise the Government on the establishment in the area of a fertiliser factory. The team consists of Dr. R. M. Gorrie (soil conservation), Professor Gardie (dry farming), and Professor A. Decamps (forestry). Choice of site will be affected by the availability of raw material in the locality. The object of the scheme would be to produce 80,000 tons of ammonium sulphate and 35,000 to 40,000 tons of superphosphate annually. Under the Colombo Aid Plan, Ceylon has expressed the desire to obtain the services of an expert to advise the Government on setting up the plant.

Southern Rhodesian Factories

Progress in developing the town of Gwelo has been noted in a statement issued by the Public Relations Department of the Government of Southern Rhodesia. All surveyed areas in the heavy industrial site have already been sold. The steady industrial development of Gwelo began soon after the war and was accelerated by the announcement last year that Rhodesian Alloys Ltd., had chosen the town as its manufacturing centre for the processing of ferro-chrome. This new company is sponsored by Messrs. Thomas Firth and John Brown, Ltd., the British South Africa Company and the Anglo-American Corporation of South Africa, Ltd. It has a capital of £1 million. Production is expected to begin about the middle of next year. The population of Gwelo has grown to over 5,000 Europeans and 9,000 natives.

Technical Publications

ETHYLENE oxide, methods of handling and precautions to prevent fire and explosion due to its variable physical state are discussed in Chemical Safety Data Sheet SD. 39, recently issued by the Manufacturing Chemists' Association, Inc., Washington, D.C. The manual contains information about warning labels, national fire codes, the Bureau of Explosives, American Standards Association and the Interstate Commerce Regulations. Prepared by the association's general safety committee, it is designed primarily for supervisory personnel and staff members, but emphasis is laid on the importance of the thorough education of employees in proper precautions.

THE 1950 Supplement on Soaps and Other Detergents published by the American Society for Testing Materials, Philadelphia, brings up-to-date the Cleaning Bibliographical Abstracts (1893-1949) published two years ago. The 32-page supplement contains 170 bibliographical extracts including 89 additional references for the period 1932-48, and 81 new references for the years 1949 and 1950. As in the original edition references are arranged by year and then by author. To facilitate reference they have also been indexed under the four headings of subject, author, specification and patent. This publication should be of considerable interest to all those concerned with the surface conditions and cleaning of metals.

PHOSPHOR copper as a deoxidising and hardening agent, and how improvements in bronze and brass melting practices may be obtained are the subject of an authoritative booklet recently issued by the Ajax Metal Division of H. Kramer & Co., Philadelphia. Simple technical explanations are given on the improvement of casting properties, fluidity, protection of melt, quick slagging, brazing and welding alloys and the importance of control and degasification. There are a number of illustrations in connection with the uses of phosphor copper.

MAINTENANCE of high standards through rigid control from the time the raw materials are received to the finished product, is one of the features of the new pharmaceutical laboratories of Abbott Laboratories, Ltd., Bede Trading Estate, Jarrow-on-Tyne. The spacious building, modern equipment and the preparation of Nembutal, Pentothal, Triodine and other ethical preparations are described in a well-illustrated brochure just issued by the company.

AN extremely useful index to the properties and suitability of application of the various cements used in the chemical industry for jointing stoneware is provided by a small pamphlet 'Cements Used in Chemical Plant Construction,' by R. Ward, M.Sc., F.R.I.C., lately reprinted by wide request by Doulton & Co., Ltd., from a first edition in 1944. Stoneware, points out the author, is largely used in chemical industry for its rigidity and inertness, but as it cannot be worked like metal and has to be in some way jointed together, the joint constitutes a weak point in the stone. Consequently there is a need, he feels, for a short survey of the limitations of the cements in use, because of the many failures found to be due to a lack of knowledge of the conditions under which certain cements will not operate satisfactorily. The writer has set himself to deal with the usual set of conditions likely to be met with in chemical industry: acid, alkaline or neutral solutions; solutions containing sulphates; solutions containing organic solvents; vibration; and variation in temperature. For this purpose, he has divided his cements into four main classes and described the suitability and unsuitability of each class for the conditions specified:

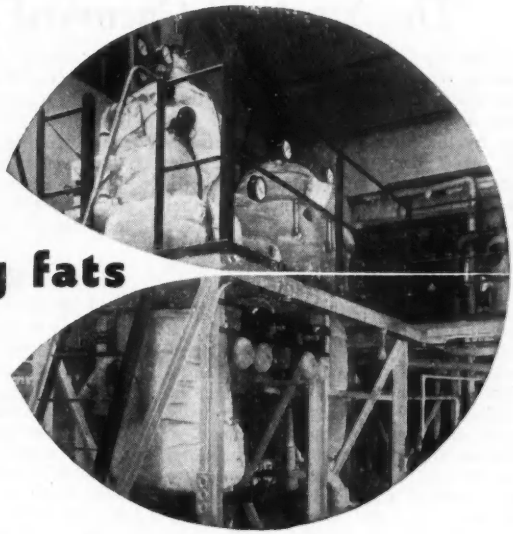
(1) Hydraulic cements (Portland, supersulphated and high alumina cements).

(2) Acid-resisting cements based on soluble alkali silicates (inert aggregates bonded with either potassium or sodium silicate solution, the aggregate being either graded silica, acid-resisting brick-dust, diatomaceous earth or barium sulphate, etc.).

(3) Rubber latex and resin cements (including rubber latex cements, synthetic resin cements, and cements based on bitumen, natural resins and sulphur).

(4) Lutes.

Having covered the properties and applications of each type of cement, the author devotes a section to each one and describes their uses in detail. Messrs. Doulton & Co., Ltd. have announced that copies of the booklet are available on request.



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The Stock & Chemical Markets

STOCK markets opened the week with another outburst of strength in industrial shares which in many cases rose to their highest levels this year. Sentiment was helped by the numerous dividend increases which have been announced since the Budget, and also by reinvestment of proceeds of selling of British Funds and other fixed-interest securities.

With the increase in income tax, the net return from gilt-edged stocks is too small for the needs of many investors who have been forced to place a larger part of their investments into higher-yielding industrial shares. Buying has been rather indescriminate, and little regard has been given to the fact that rising prices, and shortage of materials, notably sulphur, must eventually affect the earnings of many companies.

Chemical and kindred shares have participated in the upward trend of market values. Imperial Chemical changed hands up to slightly over 47s., Monsanto remained active with a further advance to 67s. 6d., Fisons were 27s. 3d., and British Glues & Chemicals 4s. units advanced to 25s.

Distillers Co. 4s. units were up to 22s. 3d., Turner & Newall recorded a fresh advance to 99s., British Oxygen were 95s., Lever & Unilever 49s., and Borax Consolidated 36s. 6d. Glaxo Laboratories advanced to 68s. 9d. on higher dividend prospects, and United Glass Bottle were up to 85s. also on hopes of an increased payment for shareholders. Triplex Glass held steady at 25s.

There was again more interest in shares of plastics companies on reports of increasing output. De La Rue were 27s. 9d., British Industrial Plastics 2s. shares 7s. 3d., British Xylonite 87s. 6d., and Kleeman 1s. shares 11s. 3d.

Albright & Wilson 5s. shares were active up to 18s. 9d., Laporte Chemicals 5s. units were 10s. 10½d., Brotherton 22s. 9d., Burt Boulton 28s. 6d., and William Blythe 3s. shares 10s. Associated Cement rose afresh to 102s., British Plaster Board 5s. shares were 14s. 7½d., and British Paints advanced to 61s. 3d. on the raising of the year's payment from 17½ per cent to 20 per cent. Goodlass Wall advanced to 44s.

Engineering shares were generally higher with the prevailing trend. Staveley advanced further to 93s. 6d. on the latest market estimates of nationalisation compensation. Boots Drug were steady at 47s. 6d., and British Drug Houses 5s. units 8s. 1½d., Tube Investments were prominent with a jump to £7⅛. Oil shares became firmer with Anglo-Iranian inclined to rally on the view that events in Persia may be taking a turn for the better. Shell moved up to 90s. on higher dividend hopes and revived talk of new capital issue prospects.

Market Reports

LONDON.—Firm price conditions have again been reported for most of the routine industrial chemicals and despite recent substantial advances there has been no apparent easing in the demand for solvents and the non-ferrous metal compounds. The effect of the sulphur shortage has resulted in a number of consumers having to curtail their operations and it is generally felt that an official allocation scheme is inevitable. The demand for the coal tar products continues to be much in excess of the quantities on offer and for most items producers are well sold ahead. Pressure for supplies of American duty free cresylic acid continues and a feature of the market has been the extreme tightness of naphthalene.

MANCHESTER.—Generally firm price conditions and a brisk demand are the dominant feature of the Manchester chemical market. During the past week the textile and allied trades and other principal consumers have been pressing for deliveries of the alkalies and other leading heavy chemicals and additional inquiries for these have been fairly numerous. Shippers have also been in the market in connection with export bookings. Taking the fertiliser market as a whole a fair movement of supplies is reported and in some cases producers are well sold.

GLASGOW.—The majority of the manufacturers of general chemicals are still experiencing difficulty in supplying, and, of course, the further increase in the price of sulphuric acid at the beginning of the week will soon make itself felt. This increase, by the way, is definitely taking second place to the concern felt in connection with supplies. The demand for chemicals is naturally very steady due mainly to the raw material position. There has been a number of inquiries emanating from overseas markets, but the lack of supplies is the governing factor.

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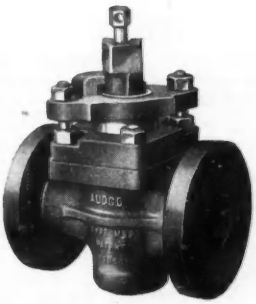

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Next Week's Events

MONDAY 23 APRIL

The Royal Institute of Chemistry

Chatham: Sun Hotel, 7 p.m. M. A. Phillips: 'Modern Chemotherapy.'

TUESDAY 24 APRIL

The Chemical Society

Leeds: The University, 6.30 p.m. Dr. J. Kenyon: 'The Use of Optically Active Compounds in the Study of Organic Reactions.' Lecture preceded by display of scientific films at 5 p.m.

WEDNESDAY 25 APRIL

The Institute of Fuel

London: The Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2, 10 a.m. Conference: 'A Study of Drying.'

Food Group (SCI)

Southport: Cambridge Hall, Municipal Buildings, 10 a.m. Discussion: 'Composition and Scientific Control in the Manufacture of Ice-cream. Synthetic Cream and other Emulsified Food Products.' (Jointly with Royal Sanitary Institute.)

THURSDAY 26 APRIL

The Chemical Society

London: Burlington House, Piccadilly, W.1, 7.30 p.m. Centenary Lecture by Prof. R. B. Woodward: 'Some Recent Advances in the Chemistry of Natural Products.'

Aberdeen: Marischal College, 7.30 p.m. Dr. H. W. Thompson: 'Studies in Infra-red Spectroscopy.' (Jointly with RIC and SCI).

The Royal Society

London: Burlington House, Piccadilly, W.1, 2.30 p.m. H. G. Thornton: 'Symbiosis Involving Micro-organisms.'

FRIDAY 27 APRIL

The Chemical Society

Cambridge: Large Lecture Theatre, The University Chemical Laboratory, 5 p.m. Centenary Lecture by Prof. R. B. Woodward: 'Some Recent Advances in the Chemistry of Natural Products.'

St. Andrews: United College, 5.15 p.m. Prof. F. A. Paneth: 'Whence Come Meteorites? Views Ancient and Modern.'

Ministry of Fuel and Power

Luton: George Hotel Ballroom, 11 a.m. Industrial Conference on 'Fuel and Management.' Speakers include: Albert Robens, M.P., W. W. S. Robertson, O.B.E. and B. E. A. Vigers, M.A.

SATURDAY 28 APRIL

Institution of Chemical Engineers

Manchester: College of Technology, Reynolds Hall, 3 p.m. H. E. Charlton: 'Chemical Engineering as Applied to the Building of a Petroleum Chemicals Plant.'

Company News

Bakelite, Ltd.

The introduction of a number of new materials as a result of its research and development work was announced in the chairman's speech to the 25th annual general meeting of Bakelite, Ltd., held in London on 6 April. The new materials include a resin for use as a reinforcing filler in natural rubber compounds; development on glass fibre laminates; and a new impregnated paper which can be used for surfacing plywood. Work on the vinyl resin programme at Aycliffe is proceeding satisfactorily and it is hoped to bring the project into operation toward the end of next year. Net profit was £298,476 (£220,366). Proposed final dividend is 15 per cent, making a total for the year of 21 per cent (18 per cent).

Ciba, Basle

Net profit for 1950 of Ciba, Basle, after allowing for depreciation, was Swiss Frs. 15.8 m. (Frs. 14 m.). Net dividend Frs. 56 per share (Frs. 49). To employees' welfare scheme Frs. 3.5 m. (Frs. 3.25 m.). To the research foundation Frs. 1 m. (Frs. 0.5 m.).

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ASSOCIATE MEMBERSHIP EXAMINATION

APPLICATION forms (returnable 1st June 1951) and particulars of the 27th Associate Membership Examination may be obtained from the Hon. Registrar, **INSTITUTION OF CHEMICAL ENGINEERS, 56, VICTORIA STREET, WESTMINSTER, LONDON, S.W.1.** *NOTE.*—Written and oral Examinations will be held in September, 1951. Home Papers will be issued in January, 1952.

SITUATIONS VACANT

PHYSICAL CHEMIST—A graduate, age about 30 preferably with a higher degree and industrial experience, is required by J. & G. Cox Limited, Glue & Gelatine Manufacturers. The individual appointed will be expected to master the technical details of manufacture, and the scientific controls used in the industry. He will understudy the Technical Director, and there will be opportunities for reasearch. Commencing salary will depend on age and experience, but will be in the range £700-£950. Applications should be sent to the **Technical Director, J. & G. Cox Limited, Gorgie Mills, Edinburgh, 11.**

QUALIFIED CHEMIST with good dyestuff intermediate experience, practical experience more important than theoretical knowledge, required for shift work at Company's new factory at Grimsby engaged in the production of synthetic organic chemicals. Age not less than 30. Good pension fund. Salary according to experience. Apply, with full details, to **Ciba Laboratories Ltd., Horsham, Sussex.**

RESEARCH AND DEVELOPMENT CHEMIST/TECHNOLOGIST required for new specialised and interesting process in Rubber Factory near London. Applicants should possess B.Sc., A.I.R.I. or A.I.R.C. qualification. They must be of British Nationality and not above 27 years of age. Experience in Rubber Technology an advantage. Salary according to age, qualifications and experience. Particulars to Box No. C.A. 3009, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

TECHNICAL RECORDS OFFICERS required by the Division of Atomic Energy (Production) at Springfields Factory, Salwick, Nr. Preston, and Windscale Works, Sellafield, Cumberland, to assess raw material requirements, progress supplies and prepare and interpret plant operating data with a view to facilitating production planning and cost control.

Candidates must have either an honours degree in chemistry, associateship of The Royal Institute of Chemistry or equivalent qualifications. They should have an interest in statistics and preferably have had some experience in a chemical factory or research establishment.

Salary will be assessed according to qualifications and experience within the range £570-£720 p.a. (if over 30) and according to age within the range £330-£545 p.a. (if under 30). Houses will be available within a reasonable period for the successful candidates if married. A voluntary superannuation scheme is in operation. Applications to **Ministry of Supply, D.At.En.(P), Risley, Nr. Warrington, Lancs.,** stating location preferred.
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QUALIFIED ORGANIC CHEMIST with practical experience required for Company's new factory at Grimsby. Good pension fund. Salary according to experience and qualifications. Apply, giving full details, to **Ciba Laboratories Ltd., Horsham, Sussex.**

THE Civil Service Commissioners invite applications for permanent appointments as **SENIOR SCIENTIFIC OFFICER** and **SCIENTIFIC OFFICER** to be filled by competitive interview during 1951. Interviews began in January and will continue throughout the year, but a closing date for the receipt of applications earlier than December, 1951 may eventually be announced. Successful candidates may be appointed immediately. The posts are in various Government Departments and cover a wide range of Scientific research and development in most of the major fields of fundamental and applied science. Candidates must have obtained a university degree with first or second class honours in a scientific subject (including engineering) or in Mathematics, or an equivalent qualification, or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience. Candidates for Scientific Officer posts taking their degrees in 1951 may be admitted to compete before the result of their degree examination is known.

Age Limits: For Senior Scientific Officers, at least 26 and under 31 on 1st August, 1951; for Scientific Officers, at least 21 and under 28 (or under 31 for established civil servants of the Experimental Officer class) on 1st August, 1951. Salary Scales for men in London Senior Scientific Officers, £700 × 25—£900; Scientific Officers £400 × 25—£650. Rates for women are somewhat lower.

Further particulars from the **Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1., quoting No. 3399.**
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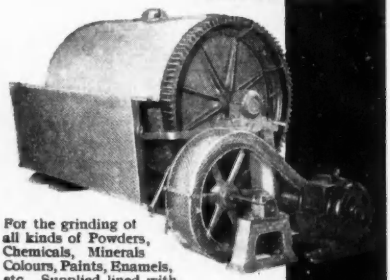

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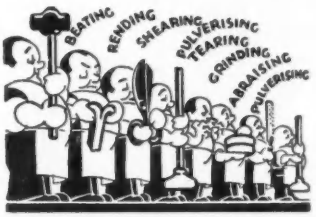

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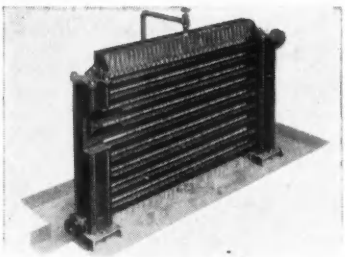

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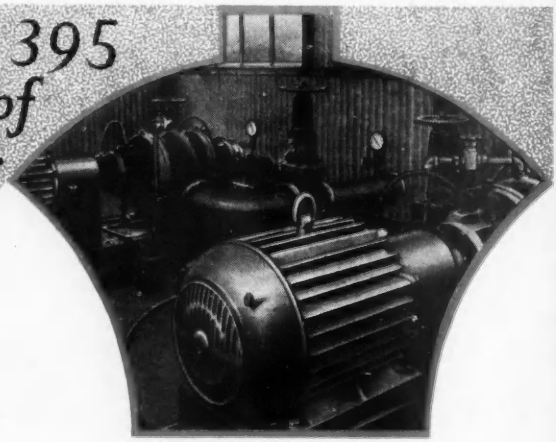

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